PRICE 50 CENTS

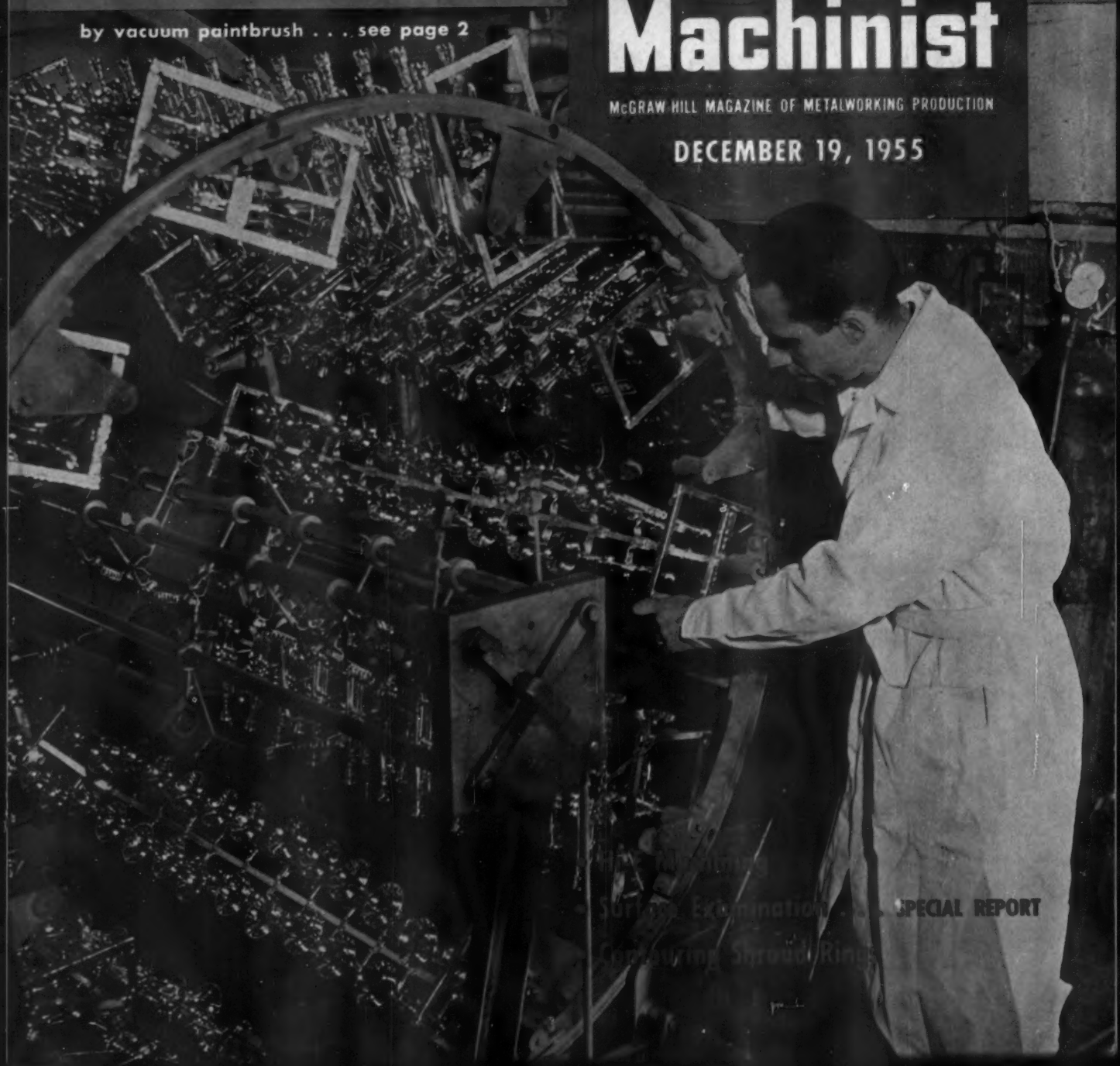
Plastic toys highlighted with metal

by vacuum paintbrush . . . see page 2

American Machinist

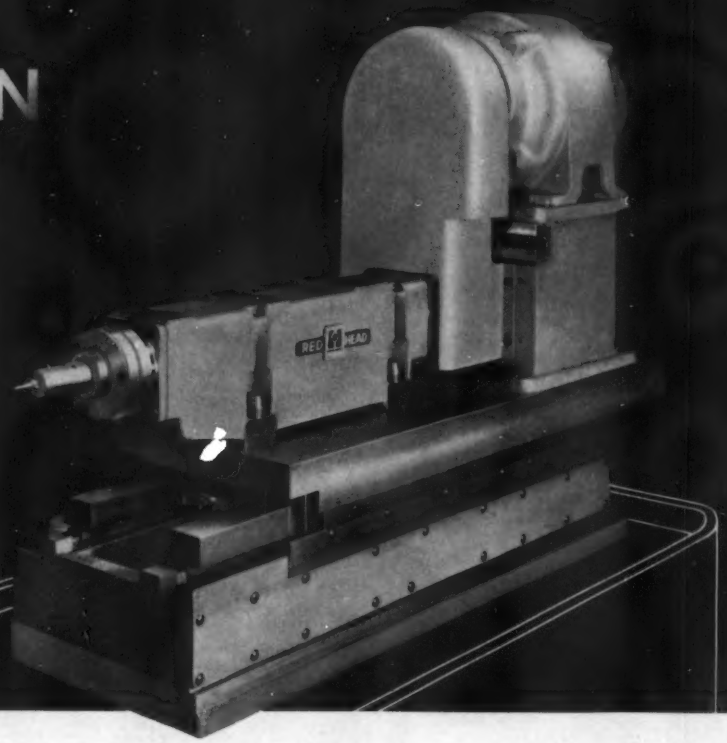
McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

DECEMBER 19, 1955



SPECIAL REPORT

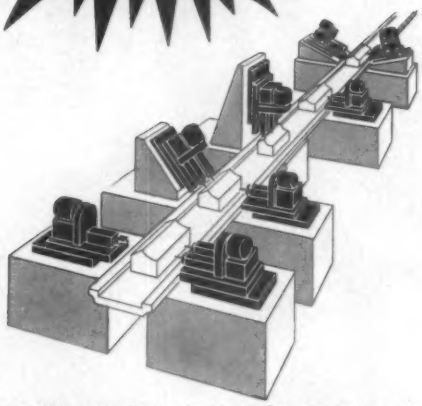
AUTOMATION SIMPLIFIED!



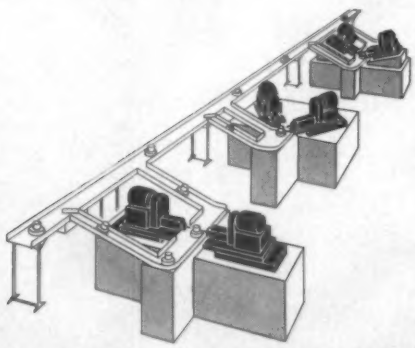
new

HEALD SLIDE-UNIT BORE-MATICS

permit important cost savings and give new flexibility on fully automated production lines



Simplified sketch of typical **transfer-type** automated production line for performing multiple operations on relatively large work. Setup includes horizontal, vertical and angular mounting of individual Slide-Unit machines—each a completely self-contained unit.



Typical arrangement of automatic, **conveyor-fed** production line for performing multiple operations on smaller work. Any number of identical Slide-Unit machines can be provided in each work station, to give the required overall production rate.

THESE simple, compact, hydraulically operated Heald Slide Units — each complete with boringhead and drive — are ideally suited to a wide variety of automated production lines. They can be mounted in any position from vertical to horizontal and can approach the work from any angle. This simplifies the design and operation of automatic workhandling, clamping and locating equipment — permits each work station to be arranged for the most efficient and economical operation.

In an automated line, each Slide-Unit Bore-Matic is a separate and completely self-contained machine, arranged through interlocking control circuits to function as a fully automatic segment of the entire production line. Hence individual machines can be added as required, permitting full automation to be achieved on an economical basis of planned expansion.

This new precision finishing development is another good reason why IT PAYS TO COME TO HEALD.

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THE HEALD MACHINE COMPANY

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Chicago • Cleveland • Dayton • Detroit • Indianapolis • New York

American Machinist

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NUMBER OF COPIES PRINTED THIS ISSUE 39,339

chips

VACUUM AGAIN . . . We sought out a cover for this issue that would combine the Christmas spirit and a new idea in Metalworking. Resulting is an unusual cover: two pictures, one of the process, the other of the products. Vacuum metallizing has been making great strides recently, so we added a lead article to tell what it is and how it is used at Ideal Toy Co, Hollis, LI, largest American toy maker. Ideal has two Stokes vacuum metallizers, each 60 in. long, a 48-in. and a 72-in. dia, the larger being shown with a load of toy trumpets emerging. In this case, the applied metal is aluminum, which will later be colored gold. So many toys have been made of scrap plastic, and sold so cheaply, that the material has been considered shoddy. Metallizing removes that onus.

HI-E . . . A new and readily understandable term, and a method of correlating all machining factors to achieve optimum efficiency, are combined in our lead article. T E Hayes of Carboloy shows how to keep from wasting as much as 50% of the savings from carbide.

SURFACES . . . The mechanism of surface failure baffles a great many people, both scientists and shop men. Once in a while an eminently capable scientist (biog) explains a successful method—by metallographic examination and deductive reasoning—for finding why a plated coating failed, why wear took place, why a sprayed metallic coating didn't stick, or some other form of surface failure spoiled a product or a production lot. The shop man has plenty of knowledge of how materials behave. Now with Dr Steer's method of investigation and analysis—as explained in our current Special Report—the shop man is a lot further along toward overcoming some of his problems.

SHROUD RINGS . . . Oldsmobile contours seven different sizes of jet-engine shroud rings at Lansing, Mich—all on the same equipment. It's a tricky job because of thin walls and complex contours. McDougall, Boye & Emmes, and Lehman lathes, all with Turchan followers, do the contouring, special Sheffield crush-form grinders do the finishing. Associate Editor De Groat tells the story, just cleared by Dept of Defense.

FLAME . . . Patrick Bruno, works manager of Simmons Machine Tool Corp, details construction and application of a home-made flame hardener built with Linde's help. It will handle shafts up to 8 in. in dia and 20 feet long.

DEEP DRILLING . . . A long spade drill, adapted so coolant can be put through the shank, drills a deep hole in a large alloy-steel part at GE. L C Kehn, manager, Mfg Engrg, Small Turbine & Supercharger Dept, describes it in a tight one-page article.

COMING . . . *AM* for Jan 2 will provide a roundup on ultrasonics to date in a compact 8-page Special Report, with 4-color cover to match. There are also articles on soldering principles, on tooling for honing, on a plating trick and a special job-order system. There's also the second of J R Paquin's series explaining details of die design.

DR A T STEER, 50, trained originally as an engineer at Leeds and London University. Having specialized in physics, he researched metals and metal-surface problems all over the world—some in Calif on high-speed aero engines. He worked out substitution of ultra-light alloy castings (after solution heat treatment) for forgings approved by the Ministry of Aircraft Production and currently done in England. During WW II, he headed research on the Rover gas turbine and tank transmissions, has since studied metals for autos and aided in development of the first jet auto. Now he is a consultant on fatigue, surface problems, moving-part wear, plating adhesion, and thin metal films. He authored our current Special Report.

How to multiply production of straight bevel CONIFLEX® gears and pinions *by as much as 500%*

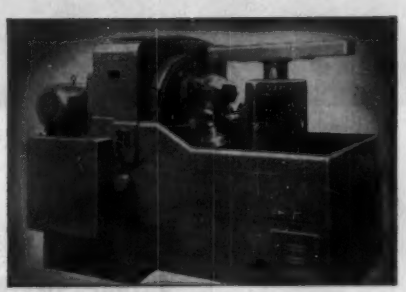
You can do it with the new No. 104 Straight Bevel CONIFLEX Generator.

The two interlocking disc-type cutters, with 24 blades each, *complete a gear in one rapid operation.*

This is the key to the remarkable performance of this new Gleason machine which achieves production rates up to 5 times as fast as any previous generator. In addition, a new generating method insures high efficiency, excellent finish, and maximum cutter life.

The range of capacity, and the ease of setup, make the No. 104 Straight Bevel CONIFLEX Generator ideal for jobbing.

Calculations have been reduced to a minimum and can be done long hand or with slide rule.



The No. 104 Straight Bevel CONIFLEX Generator completes gears up to 8½" diameter and 1⅜" face width, and from 20 to 3 DP.

We will be glad to send a bulletin giving further details on request,

® Straight bevel gears with localized tooth bearing.

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Builders of bevel gear machinery for over 90 years

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A new line of Milling

for production shops . . .

POWER

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Plain Rise And Fall
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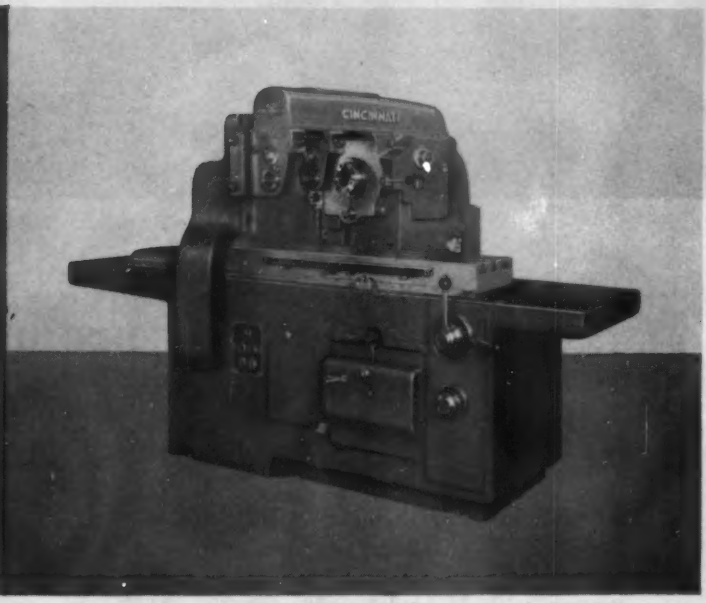

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Machines

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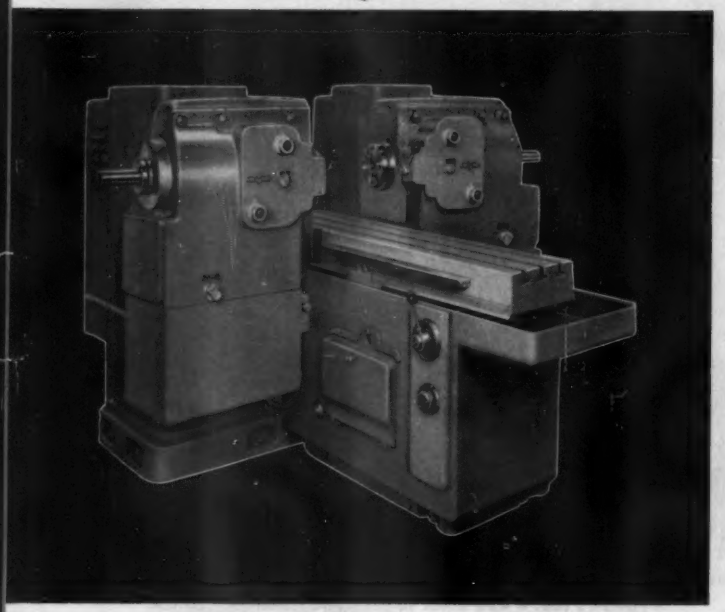
Duplex
POWERMATIC



NATI

Six-word description of the new CINCINNATI Powermatic Milling Machines . . . **versatile work horse for production shops.** These new automatics are medium-size production type millers with a powerful spindle drive . . . actually 200% more power than the previous design. 7½ hp cuts are just routine performance. And because of the many setup conveniences, you can get going fast! Change-over time from one job to the next is comparable to many knee-type millers. Just consider the cost-reducing possibilities of these Powermatic features:

Automatic two-way table cycles; reversible through a selector knob

Cycle selectors control the automatic functions; can be interchanged in a minute or two

Single lever table control; for starting automatic cycles . . . for manual control when setting up the job

Automatic backlash eliminator; adds down-milling and reciprocal milling to Powermatic versatility

Automatic spindle stop; at any point during the cycle, controlled by cycle selector

Three styles: Plain, Duplex, Plain Rise and Fall

Of course, there are many additional ways in which the new CINCINNATI Powermatics can help you produce more at a lower cost. You can't afford to overlook these fine new CINCINNATIS. Ask for catalog No. M-1913.

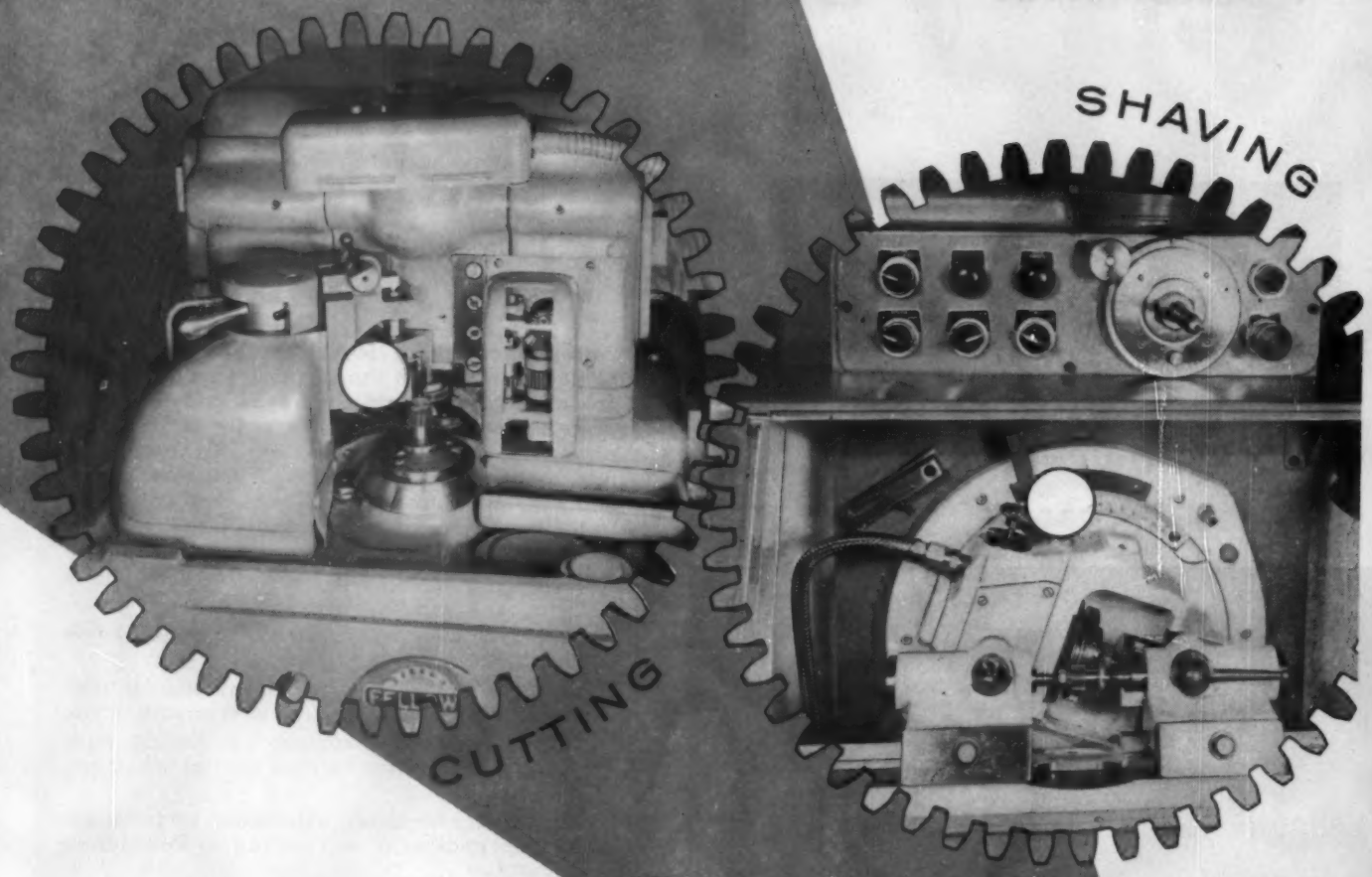
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

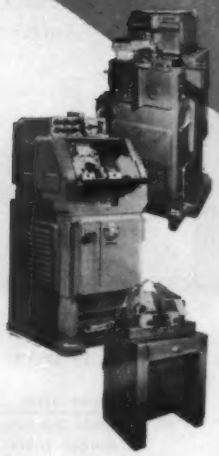
BRIEF SPECS.

seven sizes	No. 200-112 to 200-118
table working surface	11" x 55⅝" to 11" x 126⅛"
range: table travel	24" to 96"
spindle carrier	8"
quill (cross)	3"
table rapid traverse	300" per min.
16 table feeds: std.	½" to 20" per min.
high A	1" to 40" per min.
high B	2" to 80" per min.
16 spindle speeds	30-1200 rpm 50-2000 rpm (std.) 75-3000 rpm

MACHINES • FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID

FULLY INTEGRATED





Fellows 3-Inch Gear Shaper will handle work from 1/16" to 3" pitch diameter and as fine as 200 pitch on spur gears. It provides for unusually high speeds... automatic deburring, too.

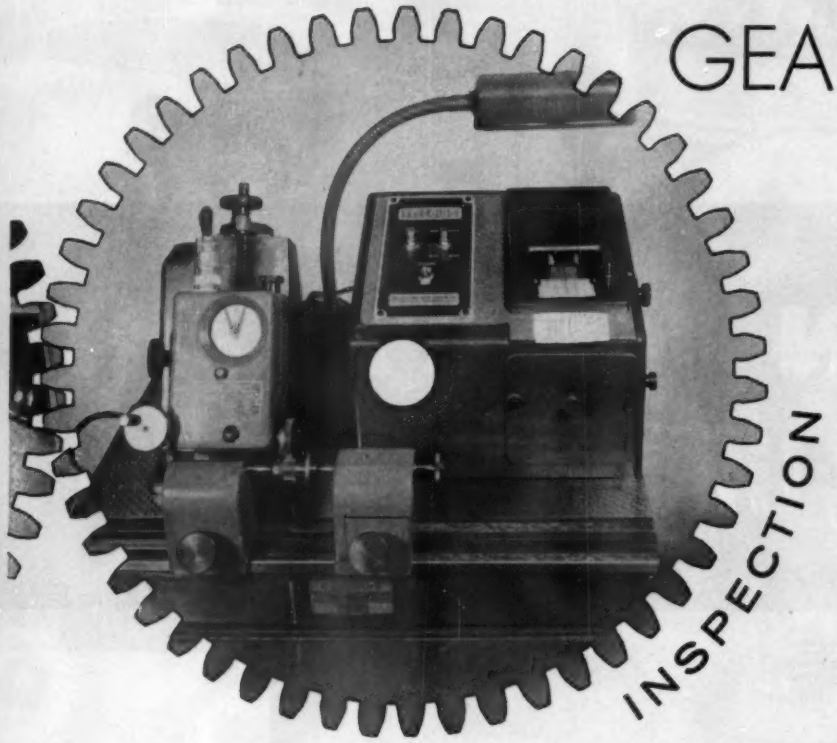
Fellows No. 4 Gear Shaving Machine provides the fastest possible finishing on spur and helical gears from 1/16" to 4" pitch diameter, 1" face width, 20 diametral pitch and finer. The last word in quality.

Fellows No. 4 Red Liner is especially adapted to the "composite check" of fine-pitch precision gears. Electrical recorder amplifies errors 200, 400 or 800 to 1 and records them on a paper chart. Very fast!

THE PRECISION LINE

PRODUCTION

FOR FINE-PITCH GEARS, TOO



At the NMTB Show, gear men had the opportunity to see for themselves how quantity production of high precision fine-pitch gears can be achieved at low cost. Using a Fellows 3-Inch Gear Shaper, No. 4 Fine-Pitch Gear Shaving Machine and No. 4 Red Liner... all fully integrated... production speeds can be obtained that a short time ago were considered impractical. Simultaneously, close tolerances can be assured which will meet the most exacting gear-train requirements for electronics and instrumentation.

If you are interested in fine-pitch gears... either as a producer or user, or both... it will certainly pay you to get all the facts about Fellows line of fully integrated equipment. WRITE, WIRE or PHONE any Fellows Office today!

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Fellows *Gear Production Equipment*

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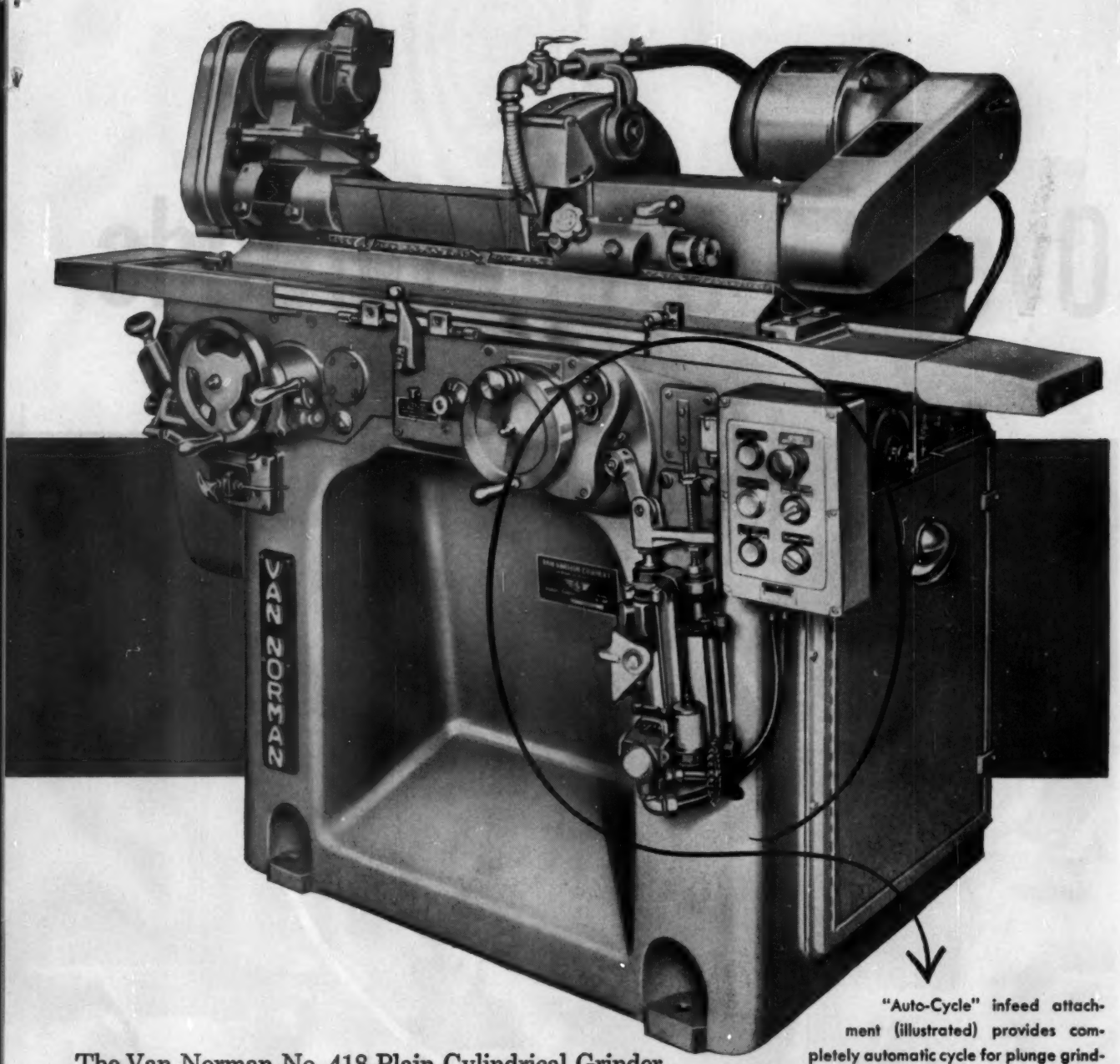
No. 418 Cylindrical Grinder

Gives You Accuracy, Speed and Economy in Precision Plunge or Traverse Grinding of Small Parts...

Don't wait . . . for extra profits install a Van Norman Machine now! They are available on five purchase plans — Outright sale . . . Purchase on conditional sales contract up to five years . . . Pay as you depreciate . . . Straight lease . . . Lease with option to buy. See your dealer or write Van Norman Company. **Lease and Conditional Sales Contracts not available to Export.**

VAN NORMAN

MANUFACTURERS of—Ram and Column Type Milling Machines, Cylindrical Grinders, Spline and Gear Grinders, Oscillating Radius Grinders, Special Production Grinders, Centerless Grinders.

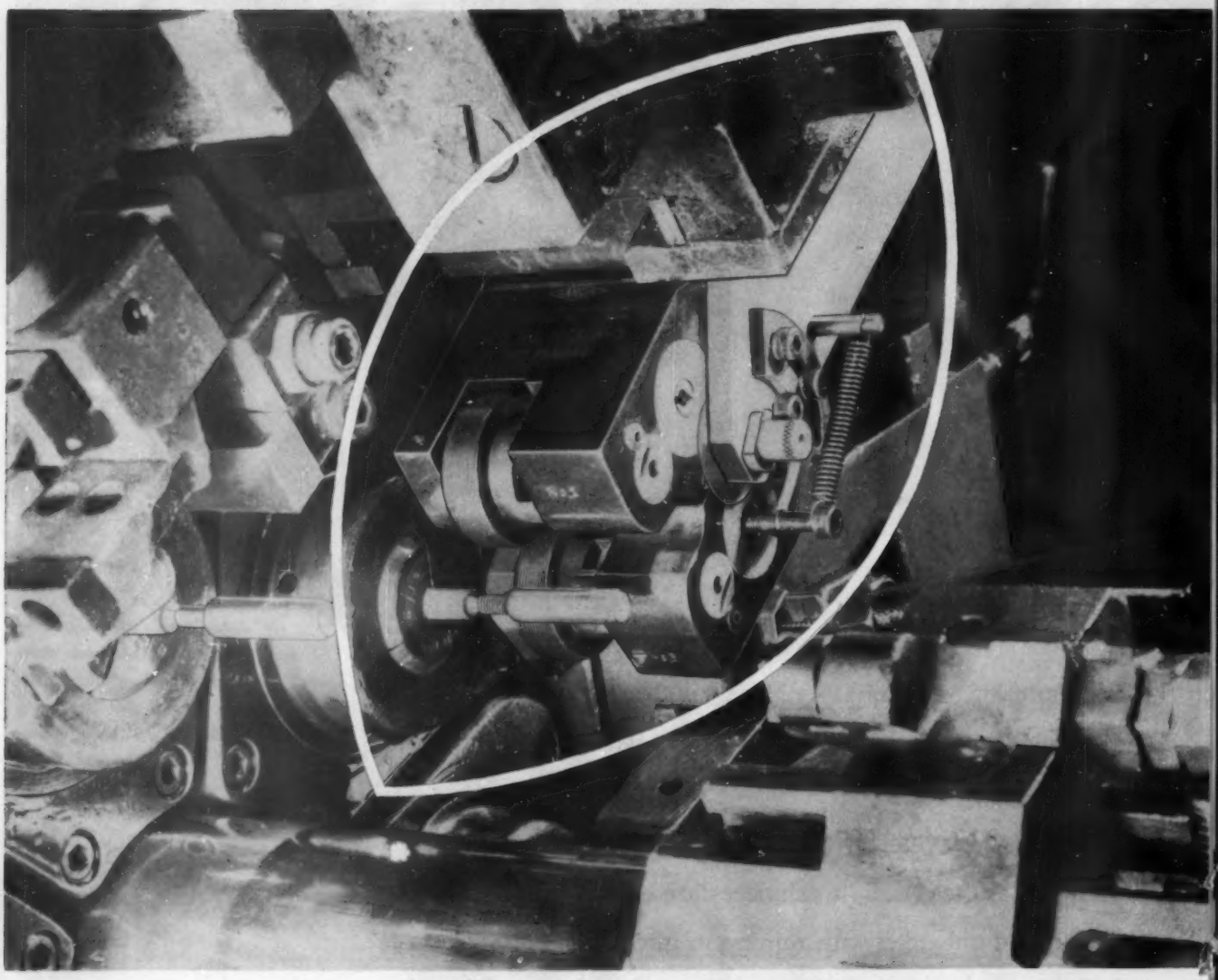


"Auto-Cycle" infeed attachment (illustrated) provides completely automatic cycle for plunge grinding at low additional cost (optional). Work size 4" Diam. x 18" Long. Grinding Wheel 14" O.D. x 2" Wide. 2 H.P. Wheel Motor — 3 H.P. Optional.

The Van Norman No. 418 Plain Cylindrical Grinder is especially adaptable for use in plants where work is in small or production runs where it will cut costs of plunge or traverse grinding of small parts. Set-ups are quick and easy . . . workpieces are easily loaded, ground and unloaded with minimum motion and effort. Call, wire or write for Bulletin giving complete details.

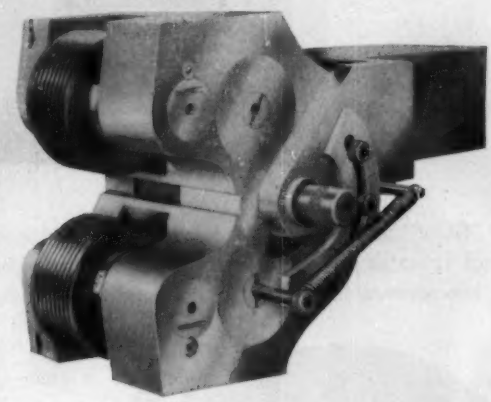
COMPANY | **SPRINGFIELD 7, MASSACHUSETTS**

Over 1,100,000 threads



THE WORLD'S LARGEST MANUFACTURER OF THREADING EQUIPMENT

with 1 set of Rolls



The economy of LANDIS Thread Rolling Attachments due to long roll life is being demonstrated in the production of studs at the M & S Morenci Corporation in Morenci, Michigan.

#10-32 pitch NF threads, .350" long, are rolled on 1020 screw stock using a #14 GA LANROLL Attachment on a 9/16" Acme-Gridley Automatic. The Attachment is operated in the 4th position, rolling next to the collet .030" back of the shoulder, and threads are held to ±.00025" of the pitch diameter. 1,100,000 threads have been produced to date with the original set of roll dies. Another Lanroll Attachment later placed in operation on the same job has to date produced 500,000 threads with its original rolls.

This long roll life is a result of the basic design of the Lanroll Attachment incorporating patented new principles. A degree of stabilization never before obtained in a tool of this type is ensured between the workpiece and the attachment. Open construction allows the use of thread rolls of the maximum diameter, distributing wear over an increased area. The accuracy and wear-resistance of the rolls themselves is the result of more than 50 years experience in the manufacture of threading tools. These rolls are precision-ground to produce uniform, accurate threads of the highest quality.

LANROLL Attachments are made in five sizes for use on bar automatics and turret lathes to roll both fine and coarse pitch threads to Class 4 tolerances. Quick and easy set-up changes assure operation of the attachment for every size within its range as though it were exclusively engineered for the particular work being threaded. The M & S operation shown here is an example of this set-up simplicity. Using only the handbook furnished with the Attachment, a satisfactory production set-up was made by a set-up man with no previous thread-rolling experience.

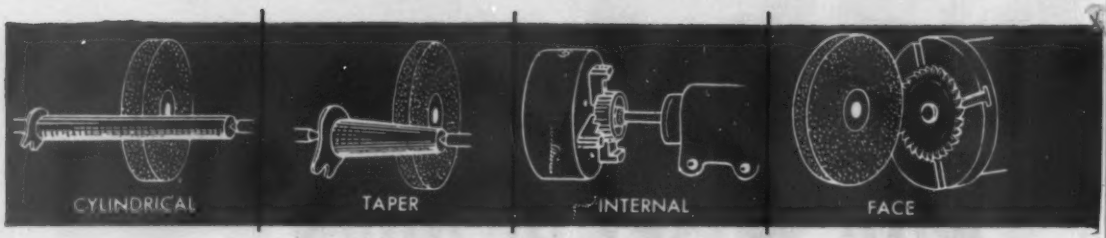
For more detailed information on construction and many exclusive features, send specifications and ask for Bulletin G-96.

LANDIS *Machine* COMPANY

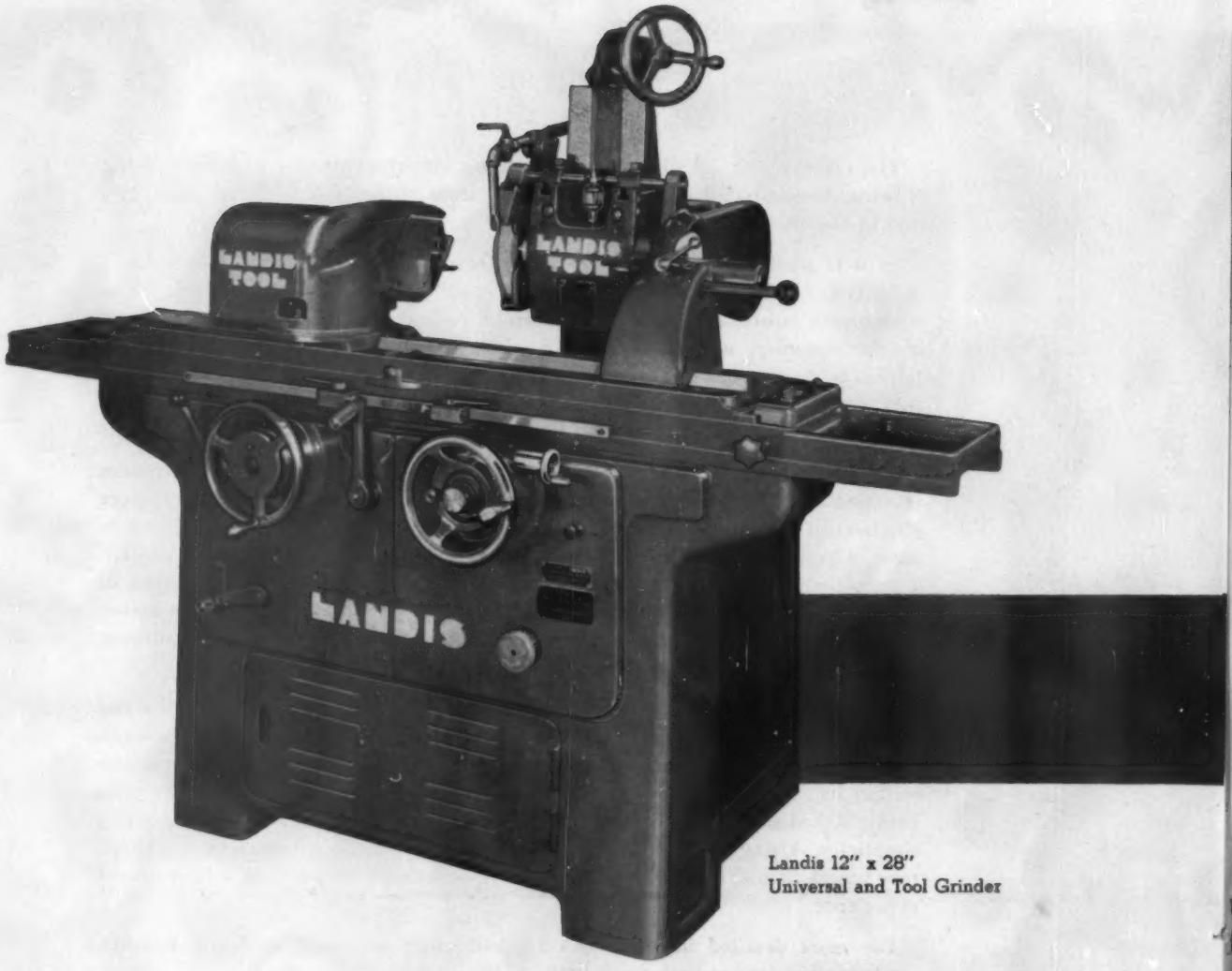
WAYNESBORO • PENNSYLVANIA • U.S.A.

450C

Your Best Buy in Small Grinders



A Universal Grinder +



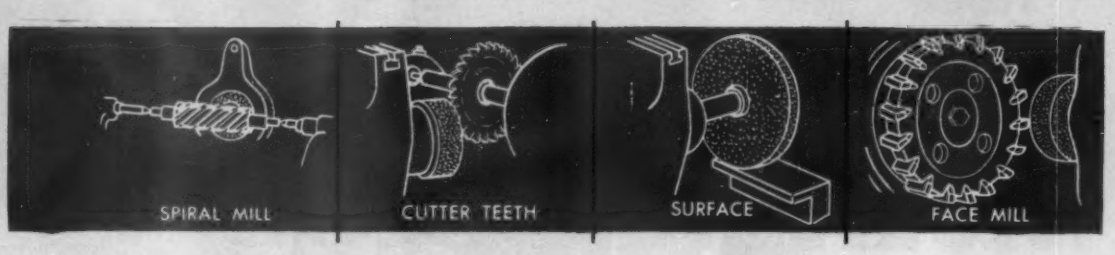
Landis 12" x 28"
Universal and Tool Grinder

LANDIS

precision grinders

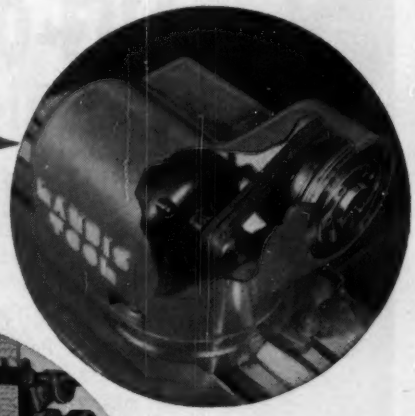
Write for Catalog K-53 for full information on the 24 different grinding operations that can be performed on this versatile machine both as a universal grinder and as a tool grinder. In includes specifications and features of this machine together with setup pictures of typical grinding operations.

2 machines in one—at low capital investment



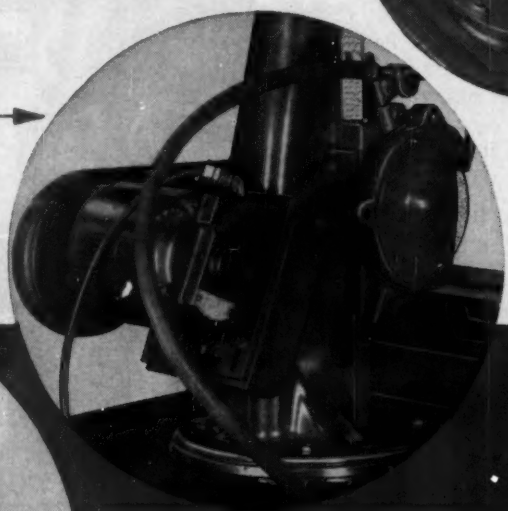
A Tool Grinder

You really get two machines in one with the Landis 12" x 28" Universal & Tool—an ideal one machine grinding department for the tool room or small shop at a big saving in capital investment over separate machines.



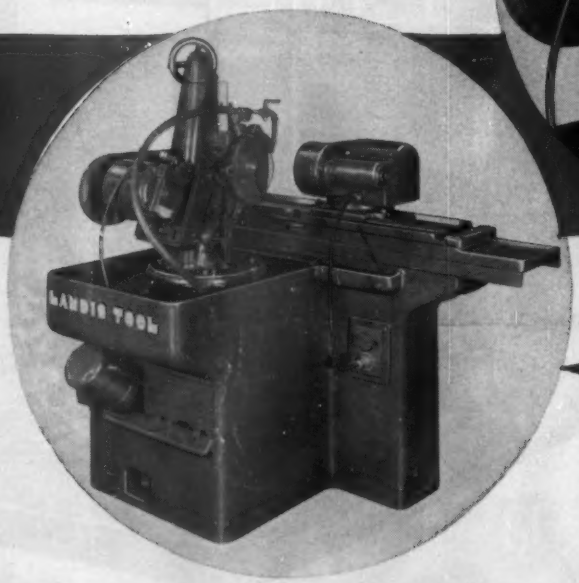
COMPACT ALL VEE-BELT HEADSTOCK

Low compact headstock particularly good for face grinding operations. All Vee-belt drive assures smooth power and fine finishes. Only two revolving parts; the electric motor and face plate or spindle.



RIGID MOTOR MOUNTING ON MASSIVE COLUMN

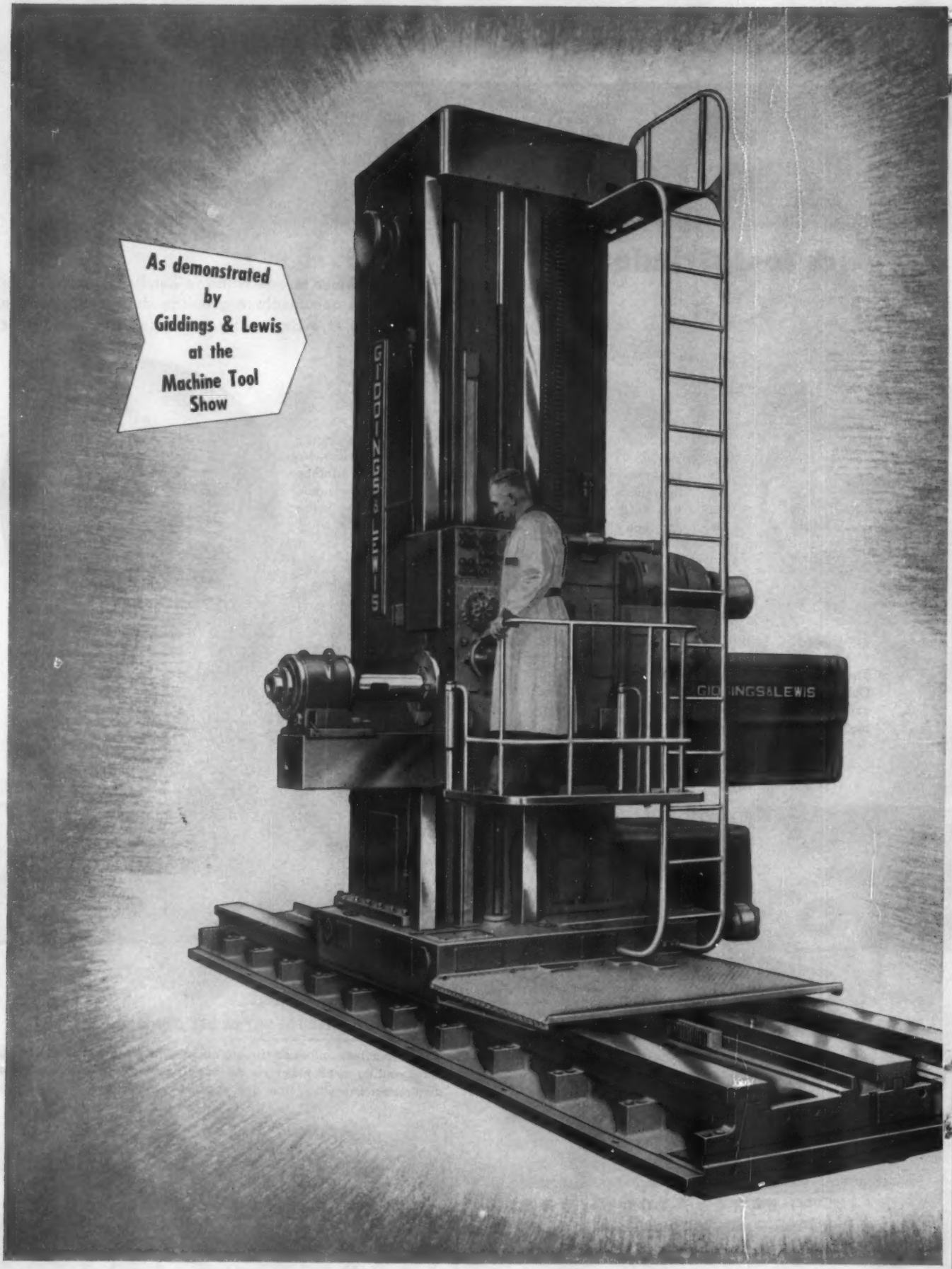
The motor is adjustable for changing belt tension. Column made with heavy sections, well ribbed. Vertical ways protected under wheel head by telescoping guides.

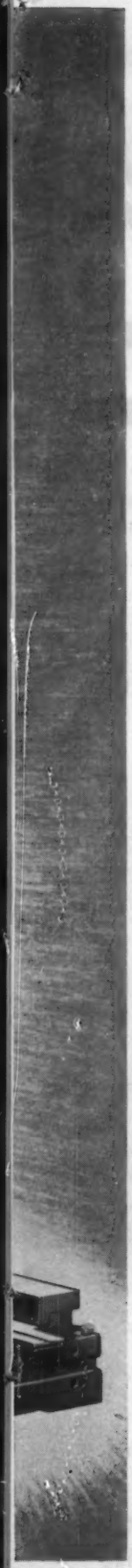


SPECIALLY DESIGNED FOR WET OR DRY GRINDING

The coolant tank and drain troughs are integral parts of the bed casting. All operating mechanisms are thoroughly protected to eliminate abrasive material resulting from dry grinding operations.

LANDIS TOOL COMPANY / WAYNESBORO, PENNA.


As demonstrated
by
Giddings & Lewis
at the
Machine Tool
Show



THE MACHINE WE CALL THE AMAZON...

the ALL-NEW Giddings & Lewis 460-FUAR

HORIZONTAL BORING, DRILLING AND MILLING MACHINE

WHEN you talk machine tools with Giddings & Lewis, you expect "something extra." And if you saw the new 460-FUAR in operation at the Machine Tool Show — you know you get that "something extra" from this machine.

The 460-FUAR is the first in a new line of Giddings & Lewis machines — designated as the 40 Series line — that combines the ultimate in modern design and appearance with a new concept in machine capacity and simplicity of operation.

These new 40 Series Floor Type Horizontal Boring, Drilling and Milling machines are available with a variety of column working heights, runway lengths and with 5" and 6" diameter spindles. The spindle underarm support and a host of other capacity-increasing optional arrangements and accessories are yours for the ordering — according to your specific needs.

The machine's spindle is provided with 32 speeds (3-800 rpm) divided over four different ranges and with 18 feeds for each of the four. You can select various spindle movements with ease — accomplished by push-buttons and finger-tip dials through multiple-disc, hydraulically-actuated clutches. Feeds to the headstock and column are infinite within .5" to 120" per minute.

When equipped with an underarm spindle support (optional) you can perform machining operations beyond the normal range of the machine. It provides that extra-rigidity for the most efficient and accurate operation of angular milling attachments, continuous feed facing heads and face plate drives.

Another profit-making innovation is the special power hoist which enables the operator to handle heavy tools and attachments without waiting for an overhead crane. This feature speeds set-up and production time.

For more information on the outstanding design features of the new 40 Series line, be sure to see your nearest Giddings & Lewis representative. He'll be glad to help you solve your production problems and tell you what this versatile, economical new line of machines can do for you.

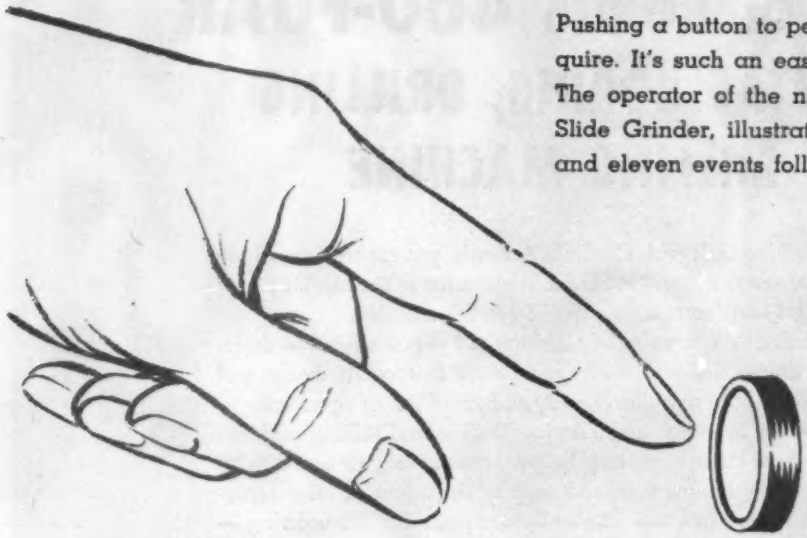
GIDDINGS & LEWIS MACHINE TOOL CO.

FOND DU LAC, WISCONSIN

Builders of the world's finest heavy-duty Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Double Housing and Openside Planers, Planer Type Milling Machines and Vertical Boring Mills; and Davis Cutting Tools.

Just Push a

diameter and adjacent are ground



Pushing a button to perform useful work is a good habit to acquire. It's such an easy way to do a better job at lower cost. The operator of the new CINCINNATI FILMATIC Angular Wheel Slide Grinder, illustrated at the right, pushes a single button and eleven events follow automatically:

1) TABLE CLAMPED IN POSITION
2) WHEELHEAD RAPIDLY ADVANCES
3) GRINDING FLUID TURNED ON
4) WORK ROTATION STARTS
5) WORK GROUND AT "COARSE" FEED RATE
6) GRINDING FEED RATE CHANGES TO "FINE"
7) TARRY
8) WHEELHEAD RAPIDLY RETURNS
9) WORK ROTATION STOPS
10) GRINDING FLUID SHUT OFF
11) TABLE UNCLAMPED

FILMATIC

To support this fine semi-automatic performance (loading and unloading are manual) the machine is equipped with automatic grinding wheel balancing, an exclusive Cincinnati feature that promotes the finest finish and saves hours of time. Of course, the spindle is mounted on the famous CINCINNATI FILMATIC bearings, the bearings of perpetual youth. And three cost-reducing types of equipment are available as extras:

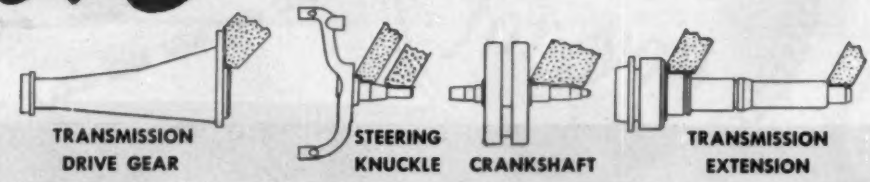
Automatic electric gage sizing with automatic compensation for wheel wear
Behind-the-wheel profile truing
Simple, effective flagging

Would you like to know more about CINCINNATI FILMATIC Semi-Automatic Angular Wheel Slide Grinding Machines? Ask for catalog No. G-647.

CINCINNATI GRINDERS INCORPORATED CINCINNATI 9, OHIO

Button...

shoulder automatically



CINCINNATI FILMATIC 14" L x 36" Semi-Automatic Angular Wheel Slide GRINDING MACHINE

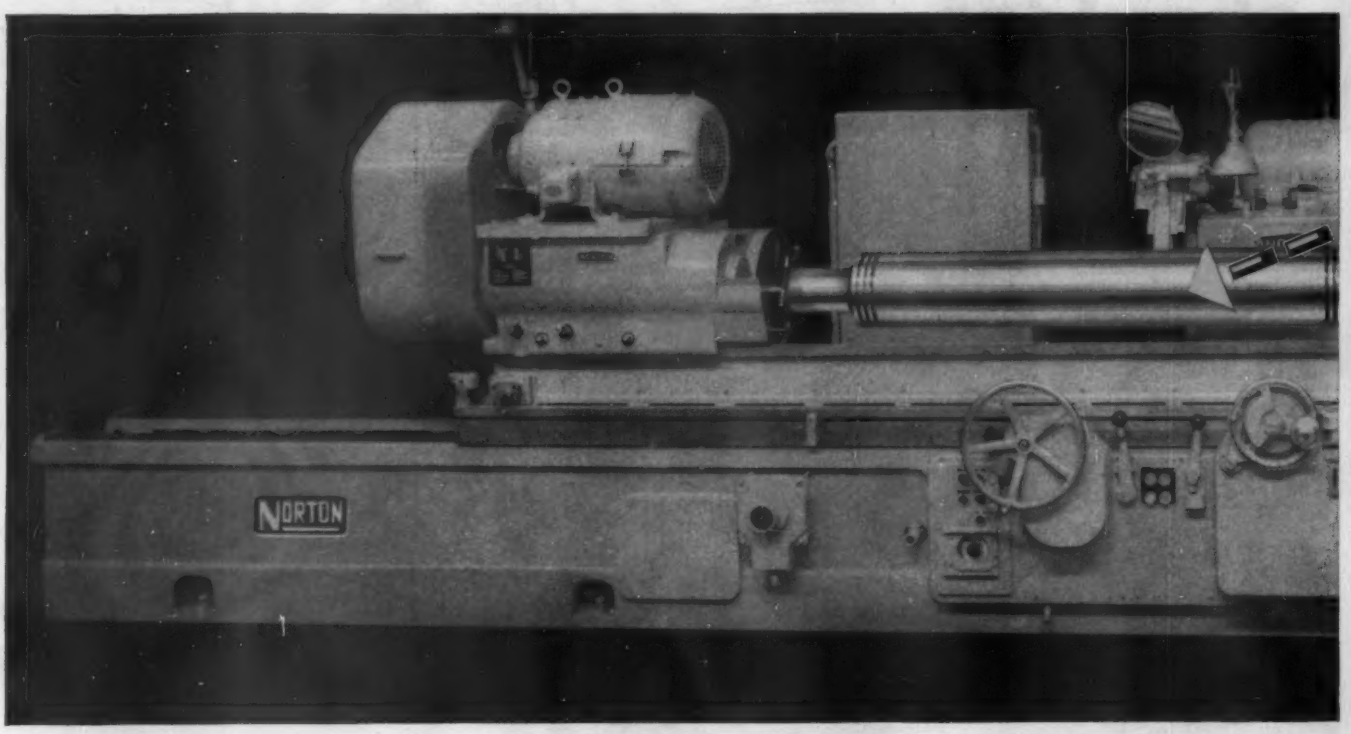
Push-button grinding saves operator effort and reduces cost. Four diameters, three radii and two shoulders are ground on steering knuckles at the rate of 96 per hour.

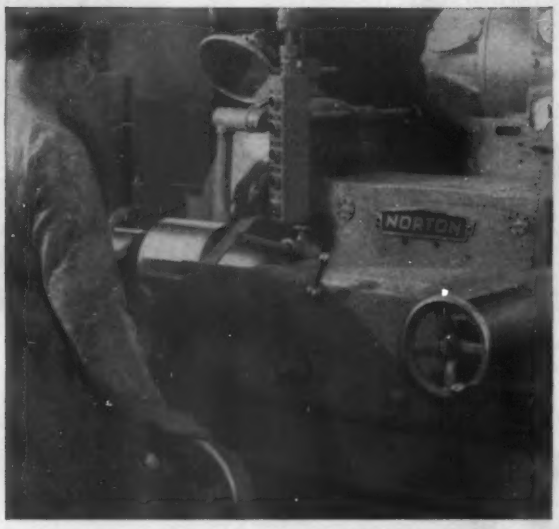
CINCINNATI

CENTERTYPE GRINDING MACHINES • CENTERLESS GRINDING MACHINES
CENTERLESS LAPPING MACHINES • MICRO-CENTRIC GRINDING MACHINES

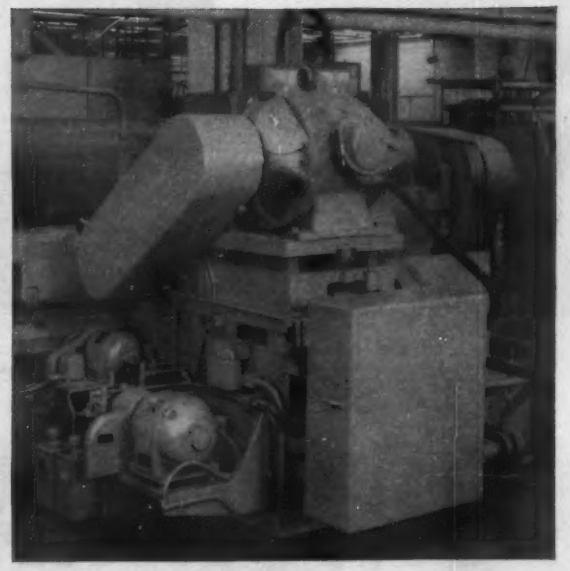
CINCINNATI

Here's a heavy duty grinder



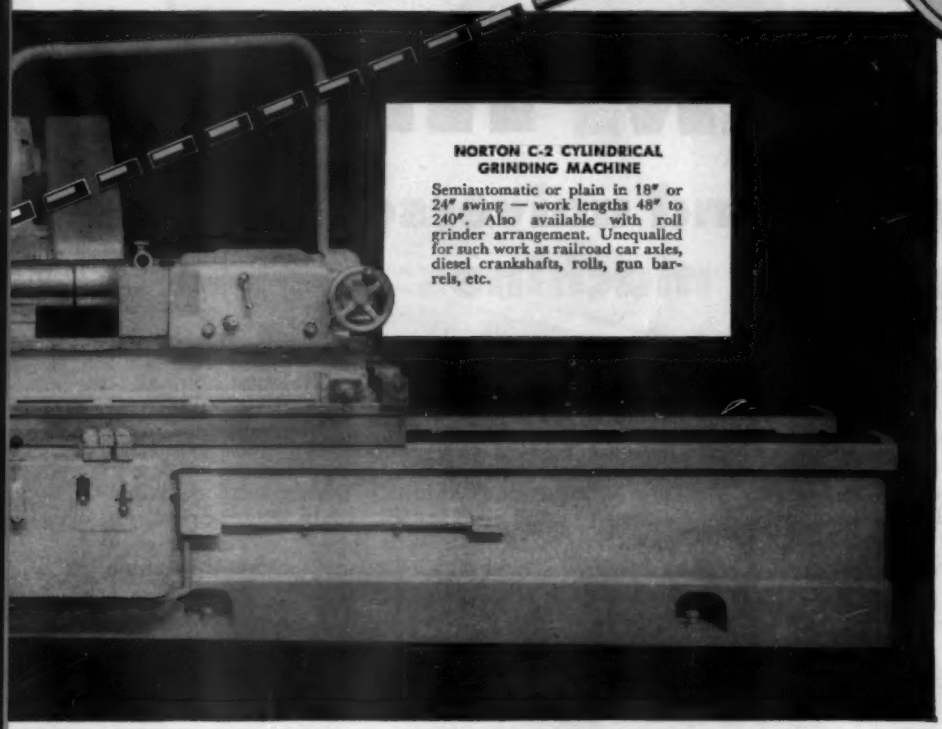


Easy To Set Up And Operate. All controls in front for minimum set-up time, quick change-over and no reaching by operator. Graduated wheel hand feed indicates feed. "Click-counter" signals adjustment for each .0001" reduction in work diameter. Table-truing and grinding speeds may be pre-set, and obtained by selector lever.



Easy To Maintain. All maintenance points on outside. Pumps, motors, filters, lubrication valves and all reservoirs easily accessible. Electrical controls grouped for easy inspection and enclosed for protection.

that can produce *bigger profits for you*


NORTON C-2 CYLINDRICAL GRINDING MACHINE
Semiautomatic or plain in 18" or 24" swing — work lengths 48" to 240". Also available with roll grinder arrangement. Unequalled for such work as railroad car axles, diesel crankshafts, rolls, gun barrels, etc.

The new Norton C-2 Cylindrical Grinder is available in 3 arrangements: Plain Semiautomatic Roll

Faster cutting . . . quicker set-up . . . easier operation . . . less down time

This is the kind of grinding machine you expect from Norton — one that's tops for accuracy, production rate and ease of operation.

The new C-2 gives you more heavy production because it works more of the time — and works faster and easier.

When arranged for Semiautomatic operation all your operator does is to move a single lever for automatic grinding to exact size and finish.

When arranged as a Roll Grinder the famous Norton tilting wheel head mechanism is supplied. This moves the grinding wheel contact point away from or toward the axis of the roll as the roll is traversed past the wheel face.

Remember: only Norton offers you such long experience in both grinding wheels and machines, to help you produce more at lower cost.

Your Norton Representative will be glad to give you all the facts on the new C-2 and to discuss your grinding problems. Or write direct to NORTON COMPANY, Machine Division, Worcester 6, Mass.

***To Economize, Modernize With* NEW**

NORTON

GRINDERS and LAPPERS

Making better products . . . to make other products better

District Sales Offices: Worcester • Hartford • New York (Teterboro, N. J.) Cleveland • Chicago • Detroit
In Canada: J. H. Ryder Machinery Co., Ltd., Toronto 5

Worth Looking At!

Kearney & Trecker's

NEW RAM HEAD

plain and universal milling machines

KEARNEY & TRECKER'S new line of Ram Head milling machines combines a conventional horizontal spindle and a self-contained motorized sliding ram. As a result, horizontal and vertical spindles can be run separately and simultaneously.

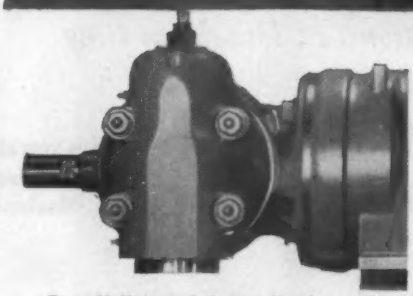
The Ram Head machines are available with a choice of three heads — Universal, Vertical and Quill types which can be rotated through 360°. You can perform vertical, horizontal and angular milling on one machine *in a single setup.*

Ram Head machines are highly versatile and exceptionally economical for general purpose production milling. They are built in Model CH, CK and CSM designs with 69 different machines in sizes from No. 2 to No. 4 in both plain and universal styles. Machines may be equipped with either Standard Directional Table Control, or Mono-Lever and Automatic Cycle Table Control.

To afford greater versatility with minimum maintenance, the Ram Head is individually motor-driven . . . has its own lubrication system and speed change mechanism. When used as a standard horizontal machine, the ram acts as a heavy-duty arbor support.

For the full story, contact your nearest Kearney & Trecker representative, or write: Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wis.

with choice of three types of heads

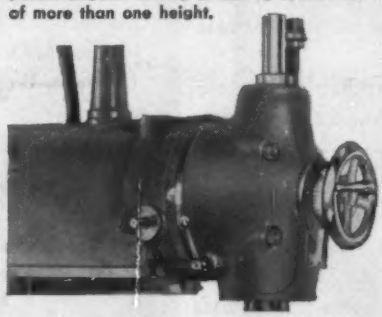


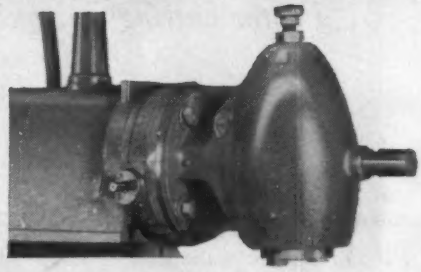
Type U Universal Swivel Head

Capable of numerous milling combinations, this Universal Swivel Head has two graduated bases at right angles to each other, both of which can be swiveled through 360 degrees. Head is rotated by worm and worm wheel with adjustment by hand crank.

Type Q Adjustable Quill Swivel Head

Spindle can be set at any angle through 360 degrees. This Ram Head has a 3½" hand-feed quill movement. In addition, four-position micrometer stop and dial indicator permit angular milling or boring operations of more than one height.



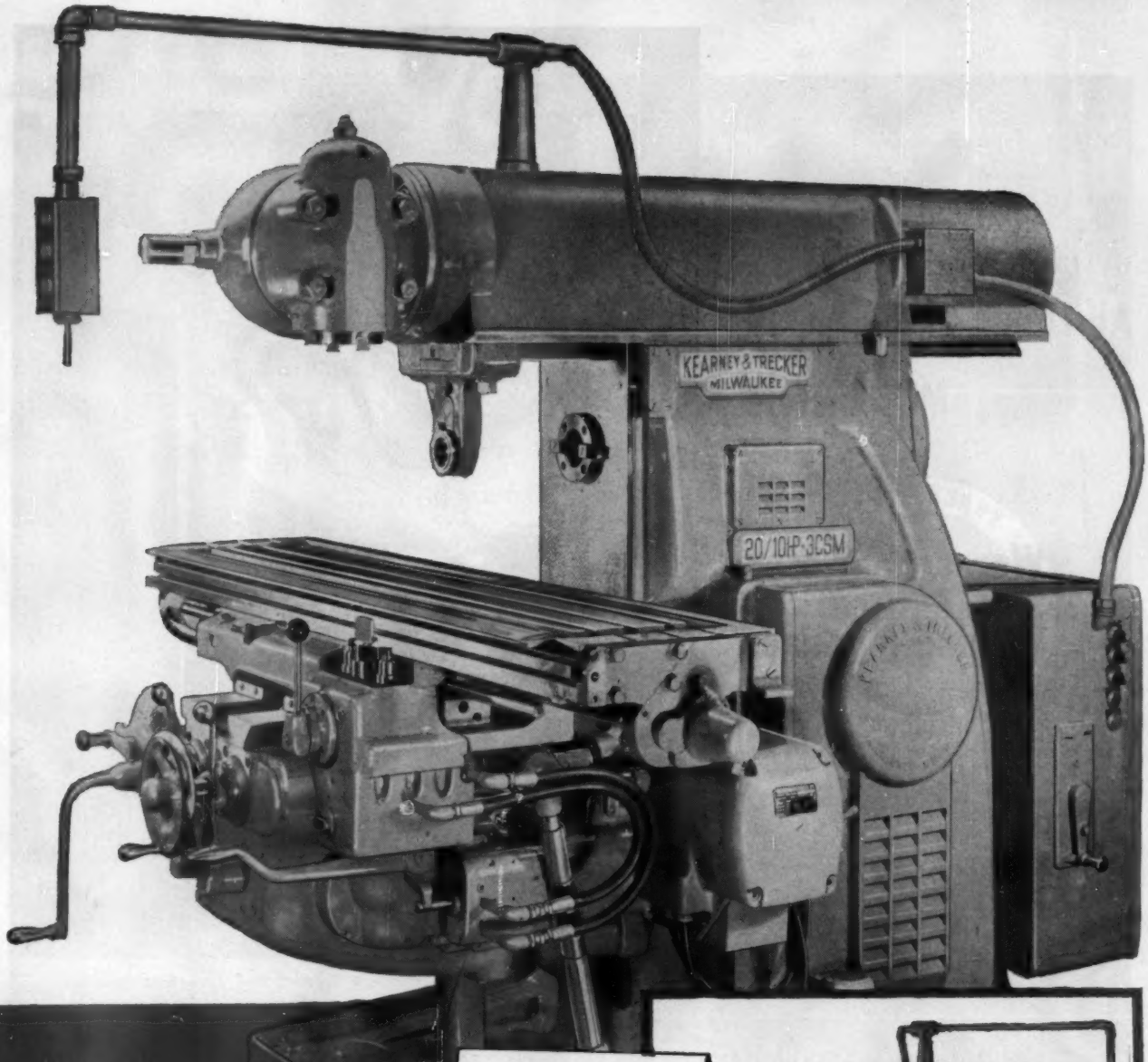


Type V Vertical Swivel Head

Especially adapted for vertical and angular milling operations. Spindle housing base of Vertical Swivel Head is graduated. Spindle can be set at any angle up to 360 degrees.

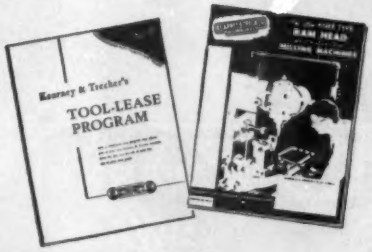
Kearney & Trecker Corporation

MILWAUKEE 14, WISCONSIN



20/10hp No. 3 Model CSM, Plain style Ram Head milling machine with Mono-Lever and Automatic Cycle Table Control and Type U Universal Head.

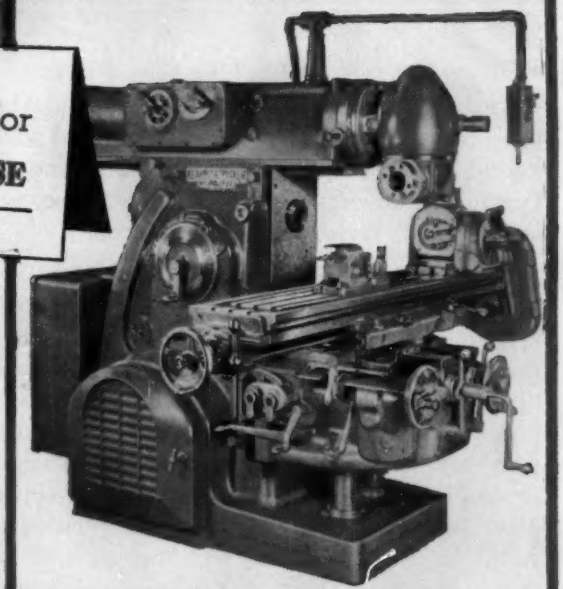
available for **TOOL-LEASE**



FREE CATALOGS!

Ask for catalog No. RH-10A for complete data on Ram Head plain and universal milling machines, and Tool-Lease bulletin, TL-10A. Also see our catalog in SWEET'S.

KEARNEY & TRECKER MILWAUKEE MACHINE TOOLS



7½ hp No. 3 Model CH, Universal style Ram Head milling machine with standard Directional Table control and Type U Universal Head.

All Lufkin Chrome-Clad Micrometers tapped on Warner & Swasey Tapping Machines

Warner & Swasey No. 11 Precision Tapping and Threading Machine in use at Lufkin Rule Company, Saginaw, Michigan.

THE NAME, LUFKIN, has long been associated with extreme accuracy by users of precision measuring instruments. However, many man-hours of selective assembly were required to assure such accuracy in Lufkin Micrometers—until Warner & Swasey helped simplify and speed up their production.

Now Warner & Swasey No. 11 Precision Tapping and Threading Machines tap the high precision threads necessary in the hub and in the thimble of the micrometer. They perform each of these tapping operations in one pass, where three were previously required. And Warner & Swasey's positive lead screw principle maintains an accurate and constant lead control in these threads. No longer must an operator "feel" his way into the work by hand, or risk damage to the finished threads on withdrawal.

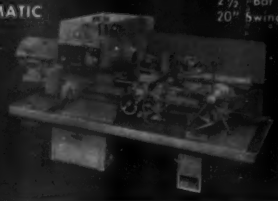
But of particular importance to Lufkin, operators can now qualify the starting positions of the taps so the "zero" mark on the micrometer's thimble matches perfectly with the reading lines on the hub when assembled. This drastically reduces the time-consuming selective and individual fitting of thimble to hub formerly necessary.

Where your work requires extreme threading accuracy on a production scale, call in your nearest Warner & Swasey Field Representative. He'll explain the many unique features of the No. 11 Precision Tapping and Threading Machine, and show you how it can improve your tapping operations.

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

NO. 4 (M-2240) AND NO. 5 (M-2250) RAM TYPE TURRET LATHES

ALL-CLUTCH AUTOMATIC SHIFTING HEAD



NO. 4 (M-2240)
2" Bar Capacity
18⅛" Swing

NO. 5 (M-2250)
2½" Bar Capacity
20" Swing

RAM TYPE TURRET LATHES

NO. 2 ALL-GEARED HEAD
1" Bar Capacity
14" Swing

NO. 3 UNIVERSAL
1½" Bar Capacity
15⅜" Swing

NO. 4 UNIVERSAL
2" Bar Capacity
18⅛" Swing

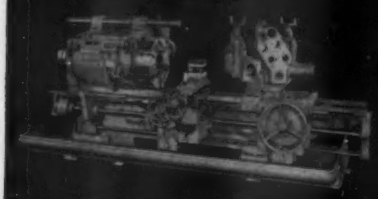
NO. 5 UNIVERSAL
2½" Bar Capacity
20" Swing

THERE is a proper size and type Warner & Swasey machine to fill your turning needs, for it has always been a cornerstone of Warner & Swasey policy to build an individual model for each type of work.

75TH ANNIVERSARY YEAR
WARNER & SWASEY
Cleveland
PRECISION MACHINERY
1880 — 1955

SADDLE TYPE TURRET LATHES

HEAVY DUTY



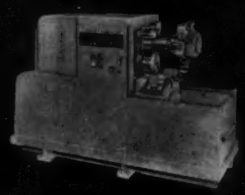
1-A UNIVERSAL
2½" or 3" Bar Capacity
16¼" Swing

2-A UNIVERSAL
3½" Bar Capacity
20" Swing

3-A UNIVERSAL
4½" or 6" Bar Capacity
23½" Swing

4-A UNIVERSAL
8", 9" or 12" Bar Capacity
28¼" Swing

SINGLE SPINDLE AUTOMATICS

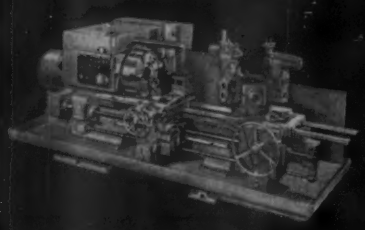


1 AC CHUCKING MACHINE
8" or 10" Chuck —
6" Working Stroke

2 AC CHUCKING MACHINE
10" or 12" Chuck —
9" Working Stroke

SADDLE TYPE TURRET LATHES

EXTRA-HEAVY DUTY



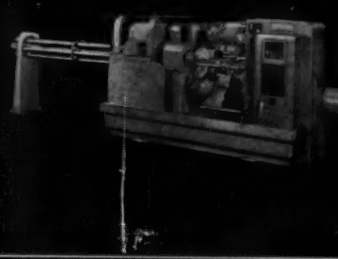
1-A UNIVERSAL
2½" or 3" Bar Capacity
16¼" Swing

2-A UNIVERSAL
3½" or 4½" Bar Capacity
20" Swing

3-A UNIVERSAL
4½" or 6" Bar Capacity
23½" Swing

4-A UNIVERSAL
9" or 12" Bar Capacity
28¼" Swing

MULTI-SPINDLE AUTOMATICS



6-SPINDLE BAR MACHINE
¾" or 1¼" Bar Capacity

5-SPINDLE CHUCKING MACHINE
6" Swing

5-SPINDLE BAR MACHINE
1¾" Standard Bar Capacity
2¼" Oversize Capacity

ELECTRO-CYCLES®

NO. 1 ELECTRO-CYCLE
⅝" Bar Capacity
11" Swing

NO. 2 ELECTRO-CYCLE
1" Bar Capacity
14" Swing

NO. 3 ELECTRO-CYCLE
1⅛" Bar Capacity
15⅜" Swing

16" ELECTRO-CYCLE
1⅛" Bar Capacity
16⅞" Swing

PRECISION TAPPING AND THREADING MACHINES

NO. 10 TAPPING MACHINE
0-80 to 10-24 Capacity

NO. 11 RS RADIAL (Single Head)

NO. 11 RD RADIAL (Double Head) 8-36 to ⅞" Capacity

NO. 11 TAPPING MACHINE
8-36 to ⅞" Capacity

NO. 12 TAPPING MACHINE
⅜" to 2½" Capacity

®Reg. U. S. Pat. Off.

DO YOU KNOW?

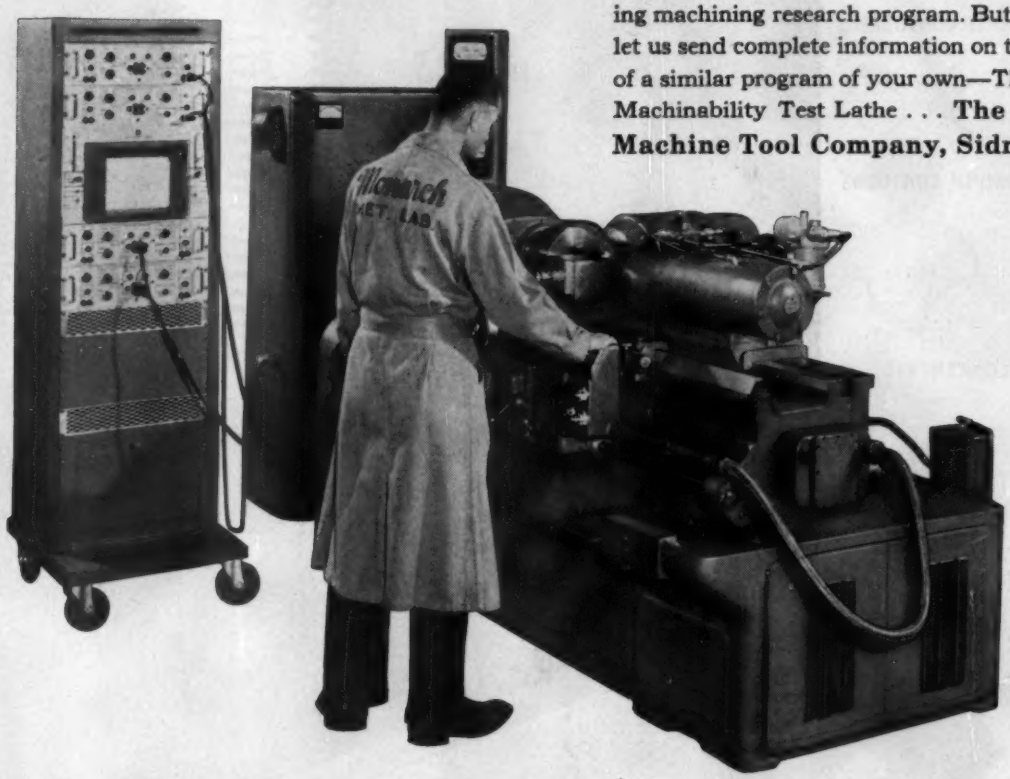
Are you
getting
optimum
production
through high
removal rate,
shortest
cycle times,
longest
tool life?

Are you sure?

MORE AND MORE MANUFACTURERS today are *making sure* through practical research evaluated and applied to shop conditions. Using the Monarch Machinability Test Lathe for individual machining tests on parts produced, they establish proper cutting speeds and tooling to produce economical tool life at high surface speeds. And it pays off in production!

With our Machinability Test Lathe and proper instrumentation you can determine the resistance of a metal to plastic deformation and the amount of energy converted into heat. You can determine normal tool wear. Measuring vertical or cutting force and feed force, you can calculate power, heat in cutting and the unit shear strength required to form a chip. And you can be sure.

Come to Sidney to see our facilities for a continuing machining research program. But meanwhile, let us send complete information on the keystone of a similar program of your own—The Monarch Machinability Test Lathe . . . **The Monarch Machine Tool Company, Sidney, Ohio.**



The Monarch Machinability Lathe. Use it for basic research (mechanics of cutting); for establishing carbide grade selection and tool wear; machinability of metals and material control; production standards. It provides an infinite range of feeds and speeds (130-3000 RPM)—a 25 H.P. variable speed drive—a versatile use of instrumentation.

Monarch
TURNING MACHINES
ACCURACY • ECONOMY • LONG LIFE
FOR A GOOD TURN FASTER . . . TURN TO MONARCH

Fill Out the Coupon and Clip to Your Business Letterhead, Please.

THE MONARCH MACHINE TOOL CO.
Sidney, Ohio

I would like more information on your Machinability Lathe. Please send your illustrated booklet #1807.

NAME_____

TITLE_____

BALANCED *Action* PERFORMANCE

Taps with these four craftsmanship-qualities will deliver it—All Winter Taps Have It

EXACT FLUTE SPACING

is the first fundamental of Balanced Action. It is accomplished by precision indexing.

UNIFORMITY OF FLUTE CONTOURS

is essential, of course. You can't get Balanced Action without it.

PRECISION CHIP DRIVER CONTOURS

are exact to size, shape, and position—formed to give the finest performance.

ACCURATE AND CONCENTRIC CHAMFERS:

By holding shank, chamfer, and thread concentricity to very close limits, hole-accuracy is assured.

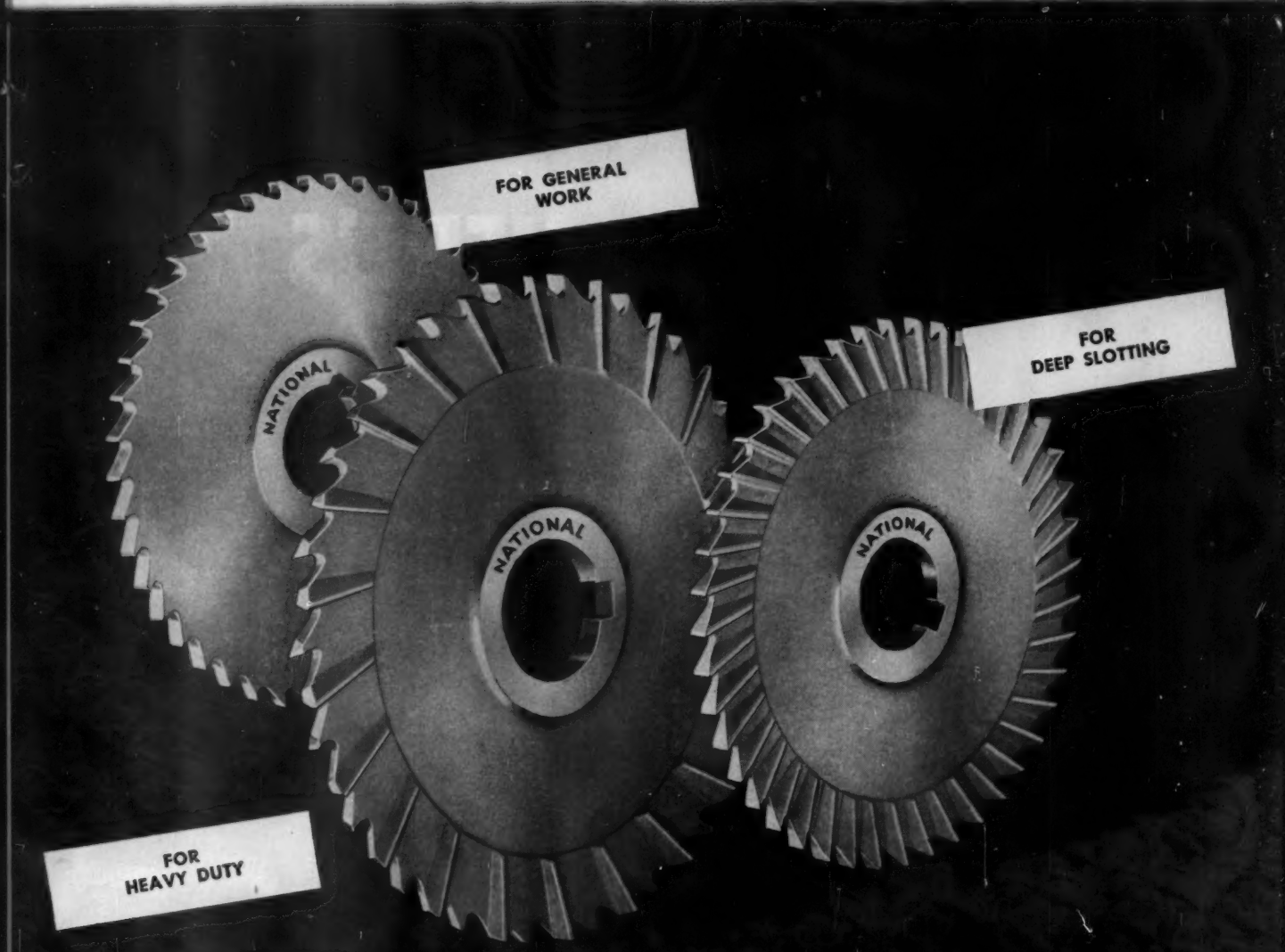
WINTER®

WINTER GAGES
plug and ring, thread and plain are made with "Balanced Action" accuracy

CALL YOUR WINTER DISTRIBUTOR

WINTER BROTHERS COMPANY, Rochester, Michigan, U.S.A.

Distributors in principal cities. Branches in New York • Detroit • Cleveland • Chicago
Dallas • San Francisco • Los Angeles • Division of National Twist Drill & Tool Co.



National

NATIONAL TWIST DRILL & TOOL ROCHESTER, MICH. U.S.A. ®

The bite that's right for your sawing and slotting

Smooth. No binding, no scoring. Saws with National cutting edges do the job the way you want it done. Immediately available—a wide range of diameters and widths; also many special types of saws and slotting cutters.

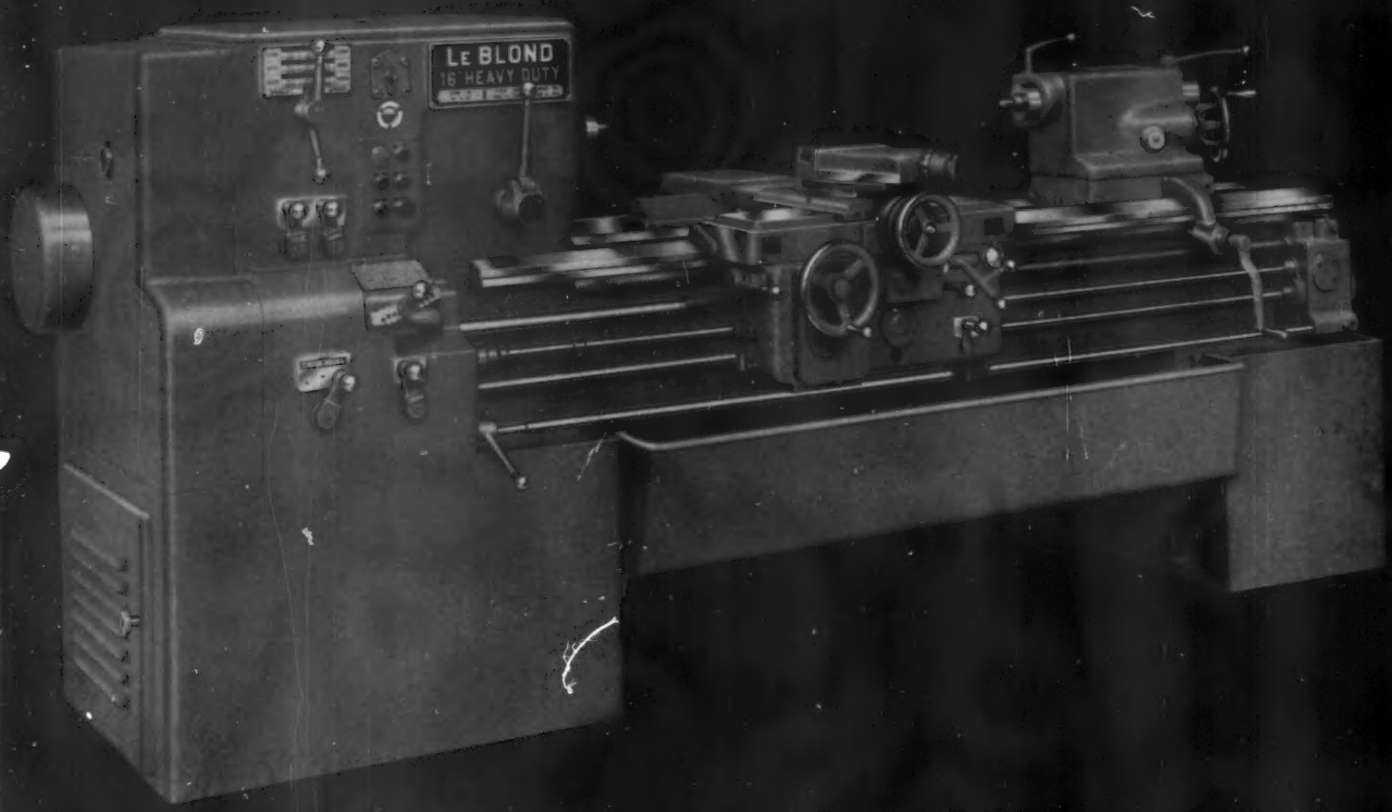
CALL YOUR NATIONAL DISTRIBUTOR

NATIONAL TWIST DRILL AND TOOL COMPANY

Rochester, Michigan, U.S.A. Distributors in principal cities. Branches in New York Detroit • Cleveland • Chicago • Dallas • San Francisco • Los Angeles

TWIST DRILLS • REAMERS • COUNTERBORES • MILLING CUTTERS • END MILLS • HOBS • CARBIDE TIPPED AND SPECIAL TOOLS

cut with confidence . . . **HERE'S THE**



New LeBlond 16" H.D. Heavy-Duty Lathe

NEW LeBLOND

16" HEAVY DUTY

stamina plus with precision

LeBlond heavy-duty engine lathes have always been known for their outstanding stamina—the inherent ability to stand up to the toughest turning jobs with precision, year after year. Our new 16" Heavy Duty is the most rugged, yet precise machine of its class that we've ever built!

The new headstock uses our proven combination gear-belt drive to give you a complete range of 27 spindle speeds from 16 to 2000 rpm chosen by direct-reading color plate. You get maximum power and smoothness from the 20-hp motor whether you're roughing or finishing—18 speeds are gear driven; 9 higher speeds are driven through a positive Gilmer-type belt that requires no adjustment. Free-running spur gear design assures minimum no-load friction horsepower . . . shafts and gears not needed for a given speed remain idle, do not consume power uselessly.

For a new degree of speed and convenience, a single lever controls the four-way power rapid traverse built into the apron. Both length and cross feed through a positive-jaw clutch are controlled by a single lever. Lubrication is entirely automatic. Bedways are hardened and ground steel inserts fitted to LeBlond's compensating veeway principle for better distribution of cutting forces. Quick-change box is totally enclosed. New tailstock uses the exclusive LeBlond thrust-lock design with a quick-set length dial.

For consistent and precise production, you can't do better than the new LeBlond 16" Heavy Duty. Call your nearby LeBlond Distributor or write for Bulletin HD-126A.

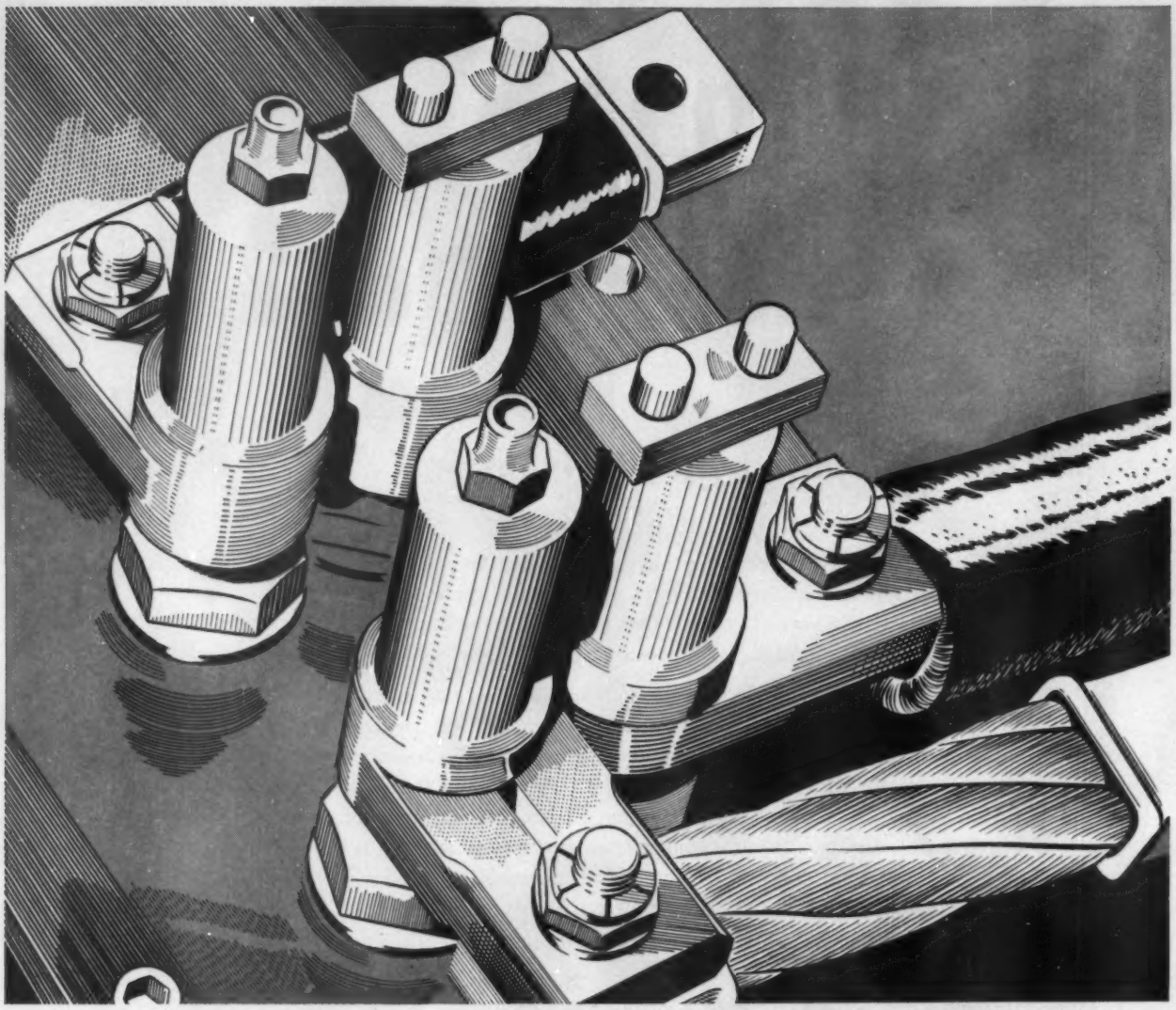
. . . cut with confidence

THE R. K. LEBLOND MACHINE TOOL COMPANY
CINCINNATI 8, OHIO

LeBLOND *of Cincinnati*

WORLD'S LARGEST BUILDER OF A COMPLETE LINE OF LATHES • *FOR MORE THAN 68 YEARS*

FLEXLOC AT WORK



DESIGNER OF WELDING DIE uses one-piece, all-metal thin FLEXLOCs as stop nuts on flexible cable assembly. Although the assembly swivels, FLEXLOCs won't work loose.

Nuts that loosen cause trouble. Contact is poor; flow of current erratic; welding faulty—and faulty welding means inferior finished jobs.

Don't take any chance of nuts loosening on vital assemblies. FLEXLOCs are made to stay put. And they are available in a wide range of sizes, types and material. See your authorized industrial distributor for Bulletin 866 and samples. Or write STANDARD PRESSED STEEL CO., Jenkintown 1, Pa.

• • •

Use FLEXLOCs anywhere safely

ON ROUGH BOLTS. They'll smooth out bolt threads without damaging the threads of the nut.

IN TEMPERATURES TO 550°F in plated nuts and even higher in unplated ones. High temperatures do not affect FLEXLOCs. Nuts with non-metallic inserts fail under such conditions.

AS STOP OR LOCK NUTS. After at least 1½ threads of a standard bolt are past the top of the nut, the FLEXLOC stays put.

REGARDLESS OF MOISTURE, OIL, DIRT OR GRIT. None of these conditions make any difference to a FLEXLOC, and vibration won't loosen it.

FLEXLOC®
LOCKNUT DIVISION
sps
JENKINTOWN PENNSYLVANIA

A view of the new, greatly enlarged Norton Sample Processing Department, showing latest types of tumbling barrels, abrasives and auxiliary equipment.

Find out what barrel-finishing can do for you

Make the Norton Sample Processing Department your proving ground for faster, lower cost production methods

If you're still finishing metal parts the long, hard, expensive way — with out-of-date tumbling or off-hand methods — here's your chance to find out how you can improve product quality and cut production time and costs.

The newly enlarged Norton Sample Processing Department puts at your disposal the very latest advances in barrel finishing — including equipment, abrasives and techniques.

Perhaps you'd like to speed up your deburring or descaling operations. You may have complicated parts. You may want to get a better color on your finish, or a lighter cut on die castings so as not to cut under the smooth outside surface.

Whatever your finishing problems, just send us sample parts — and they can range from tiny needles to hefty forgings. Without charge or obligation Norton production engineers will find out just what tumbling will do for you. Your finished parts will be returned along with a detailed report telling you exactly how to get best results from tumbling in your plant. This includes recommendations as to barrel type, size, speed and time cycles . . . type, size and amount of abrasive media to use . . . proportion of compound or cleaner to water, and other data.

What To Send Us

Along with your unfinished parts please forward: (a) a finished sample to be matched (hand-finished if necessary); plus (b) information on your present barrel finishing equipment, if any, including type and size of barrel and speeds. Address the Sales Engineering Department, Abrasive Division, NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone directory, yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

G-300

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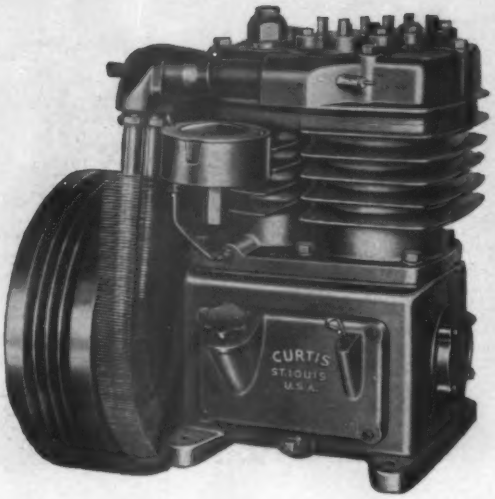
AIR COMPRESSORS
AIR HOISTS
AIR CYLINDERS



A plentiful supply

of air to speed production throughout your plant is assured with powerful, precision-built *Curtis* Air Compressors.

- **air-cooled, two stage—¼ to 20 H.P. inclusive**
- **water-cooled, single stage—20 to 50 H.P. inclusive**
- **Timken tapered main bearings permit easy external adjustment**
- **long-life pressure-lubricated connecting rod and piston pin bearings**

Tank-mounted compressors in sizes from ¼ through 15 H.P. inclusive (1 to 78 cu. ft.)—also available in base-mounted type.

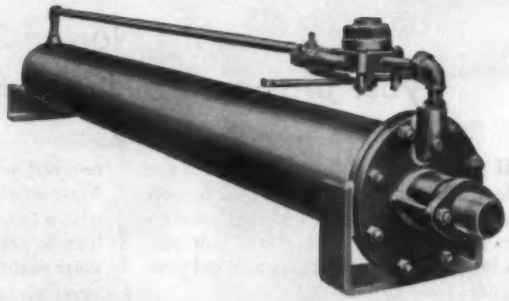
Simple and base-mounted compressors from ¼ through 50 H.P. inclusive (1 to 300 cu. ft.).

LIFT, LOWER, PUSH or PULL

easily, economically and safely with *Curtis* Air Hoists and Cylinders . . . capacities up to 10 tons.

- **lower initial cost**
- **lower maintenance costs**
- **smooth operation and precision control**
- **self-closing, rotary disc self-grinding valves**

PENDANT AIR HOISTS . . . ideal for any lifting or lowering operation.



BRACKETED AIR CYLINDERS . . . can be mounted horizontally or vertically for lifting, lowering, pushing or pulling.

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Production Pointers from GISHOLT

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

Highlighting the great, new Gisholt MASTERLINE Machines—emphasizing new strides in efficiency and in lowering unit costs on a variety of jobs.

SPEEDS UP WORM SHAFT OUTPUT

New Gisholt No. 12 Automatic with JETracer turns trick

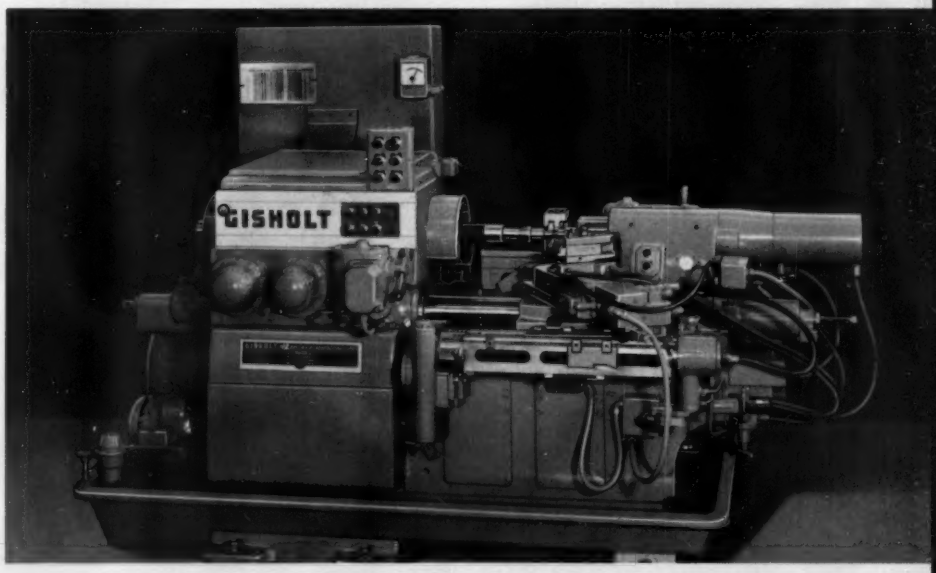
Here's how to boost production and cut costs on steel traverse worm shafts, using the new Gisholt MASTERLINE No. 12 Automatic Production Lathe.

Special equipment includes a Gisholt JETracer Slide mounted on the front carriage, plus a new triangular shaped tool post—hydraulically operated and automatically indexed—carrying a roughing and finishing tool. This arrangement permits maximum tool clearance with a minimum of overhang. Machining is fast, with a spindle speed of 900 RPM and a 40 HP motor providing power for the heavy roughing cuts.

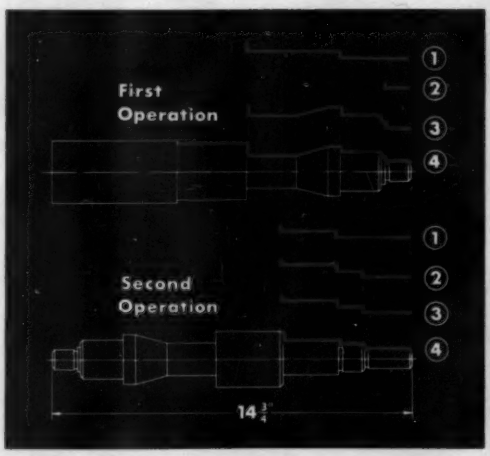
For the first operation, the rough bar stock is held between centers and driven by a work driver. As indicated in the drawing, one end of the part is rough and finish turned in four consecutive automatic passes. The tool post indexes automatically, presenting the finishing tool to the work for the final pass. At the same time, the grinding relief is formed from the rear independent slide. Floor-to-floor time: 3 minutes.

The second operation is equally easy and simple: the work driver jaws, templates and rear independent slide tools are changed—and the part is completed by four more automatic passes, with grinding reliefs formed from the rear independent slide during the finish turn. Floor-to-floor time: 2.80 minutes.

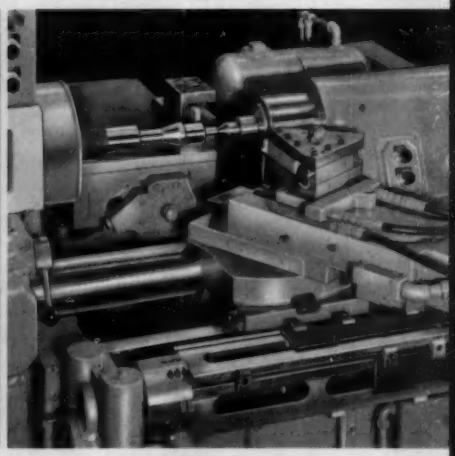
On this job, four consecutive automatic passes are made with four different templates to complete each operation.



New design refinements give Gisholt No. 12 MASTERLINE Automatic Production Lathe even greater capacity, versatility and ease of operation.



Special cam carrier indexes to present different template for each pass.



Closeup shows Gisholt JETracer Slide and automatic indexing tool post.

WITH THE GISHOLT MASTERLINE

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

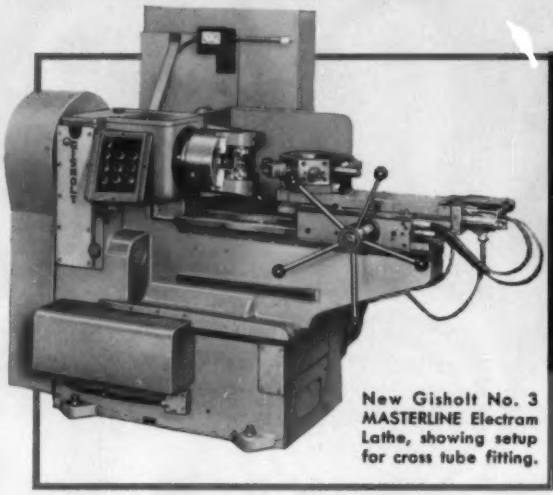
FOUR ENDS MACHINED IN SINGLE OPERATION

New Electram with pre-set controls boosts production

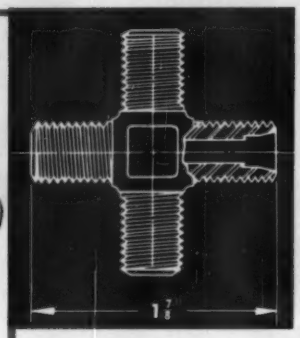
Here is a fast, positive, low-cost solution to handling parts requiring machining on two or more ends or sides—such as small to medium valves, tees, crosses, etc.

The machine is the new Gisholt MASTERLINE No. 3 Electram Lathe. The workpiece is a steel union cross tube fitting. All four ends are machined in a single chucking.

A Gisholt-Weatherhead Chuck is used to permit power indexing of the workpiece without stopping the spindle. Electrical controls at the rear of the turret ram are pre-set for each turret station and govern spindle speed, spindle reverse for tapping, spindle stop and single or double indexing of the hexagon turret.



New Gisholt No. 3 MASTERLINE Electram Lathe, showing setup for cross tube fitting.



Steel union cross tube fitting, showing surfaces machined on all four ends.

Hexagon turret tools face, chamfer, center, turn O.D., drill, form a 24-degree angle seat and a 15-degree angle bushing seat at all four ends. The workpiece is indexed in the chuck, so that tools on each hexagon turret station machine all four ends before indexing to the next turret station. To complete the part, all four ends are threaded, with the spindle reversing each time to withdraw the die head. Floor-to-floor time? Just 1.50 minutes.

Through this well-planned setup, multiple operations are handled on each of four ends of union cross tube fittings—with high volume output at lowest cost.

JETracer SAVES ON TIME, TOOLING COSTS, INSPECTION

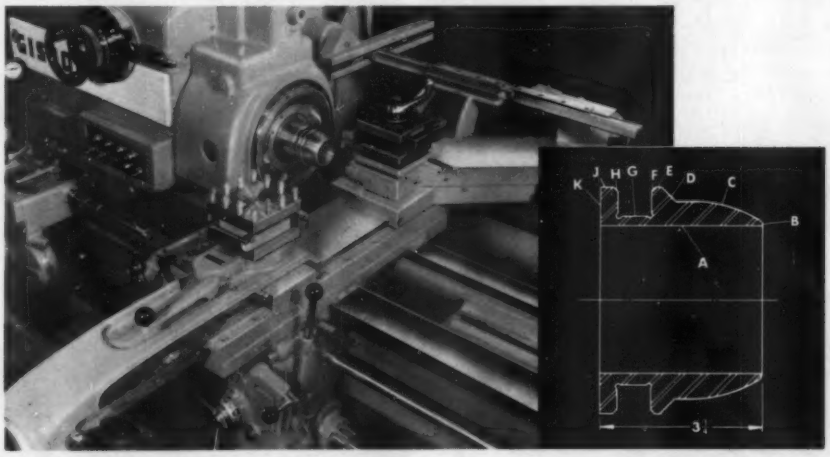
Simple application on Saddle Type Turret Lathe

The problem: how to machine steel bar feed wedges from 4½" diameter stock in one fast operation.

The solution: a new Gisholt MASTERLINE 2L Saddle Type Turret Lathe, equipped with a JETracer and a 40 HP motor.

To feed the 4½" diameter bar stock through the 4⅜" spindle bore, an outside operated collet chuck is used. The JETracer, mounted on the rear of a bridge-type cross slide, provides an economical means of accurately machining the contoured O.D. of the wedge. Considerable time is saved, tooling costs are reduced and inspection is greatly simplified.

Machining begins with the rough bar stock fed through the collet, against a hexagon turret stop. Other hexagon turret tools start drill, drill and rough and finish bore A. A single



All surfaces handled in one fast operation. Close-up shows JETracer on rear of bridge-type cross slide.

cutter turner reduces the stock O.D. in preparation for contour turning. Square turret tools rough and finish groove and chamfer F-G-H. The JETracer carries two tools (in an indexing-type square turret) which rough and finish generate B-C-D-E-J in two quick passes. The bar feed wedge is cut off at K from the front of the cross slide, and the job is finished. F.t.f. time is 8.50 minutes.

Time is saved and inspection is simplified on this job through a most modern machine and smart tooling.

TIME-SAVING IDEAS

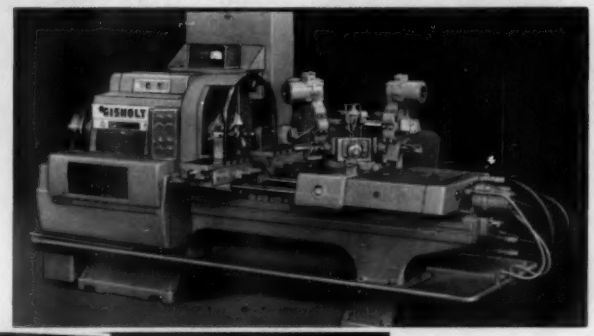
NEW FASTERMATIC CUTS SETUP TIME 50%

Simple toggle switches govern all machine functions

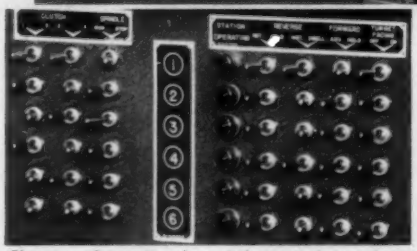
This new Gisholt MASTERLINE 2F Fastermatic Automatic Turret Lathe makes quick work of steel gear blank forgings. The secret is a new, electrically-controlled setup panel which simplifies and shortens set-up.

GEAR A—*Operation 1:* Hexagon turret fully tooled for both operations. Stations 3 and 6 bypassed. Stations 1, 2, 4 and 5 machine A-D-G-H. Cross slide tools machine B-C-E-F. F.t.f. time: 5.05 minutes. *Operation 2:* Change-over—one hour. Cross slide tools and chuck jaws changed, cross slides set to operate with stations 3 and 6. Stations 1, 2, 4 and 5 by-passed. Stations 3 and 6 machine M-J. Cross slide tools machine K-L-N-P. F.t.f. time: 1.50 minutes.

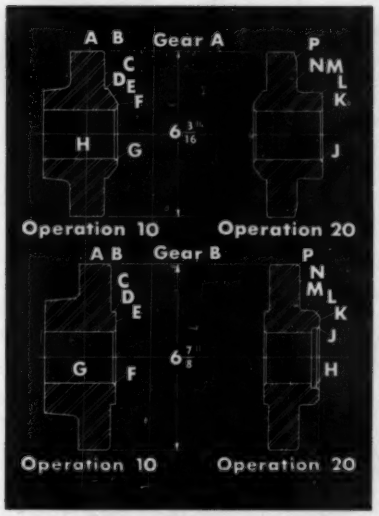
GEAR B—*Operation 1:* Change-over—1¾ hours. Adjust tools on stations 3, 4, 5 and 6 and change on stations 1 and 2 and on cross slides. Chuck jaws and spindle speeds changed and cross slides set to operate with stations 1 and 4. Stations 3 and 6 by-passed. Stations 1, 2, 4 and 5 machine A-F-G. Cross slide tools machine B-C-D-E. F.t.f. time: 5.75 minutes. *Operation 2:* Change-over—1 hour. Cross slide tools and chuck jaws changed, cross slides set to operate with stations 3 and 6. Stations 1, 2, 4 and 5 by-passed. Stations 3 and 6 machine M-H-J. Cross slide tools machine K-L-N-P. F.t.f. time: 1.39 minutes.



New Gisholt MASTERLINE Automatic Turret Lathe, designed to cut setup time 50%.



Close-up shows toggle switch control panel on new Gisholt Fastermatic.



Initial setup of the new Fastermatic is fast—simple toggle switches are set to govern all machine functions. On re-runs, a master reference card is used to further setup time.

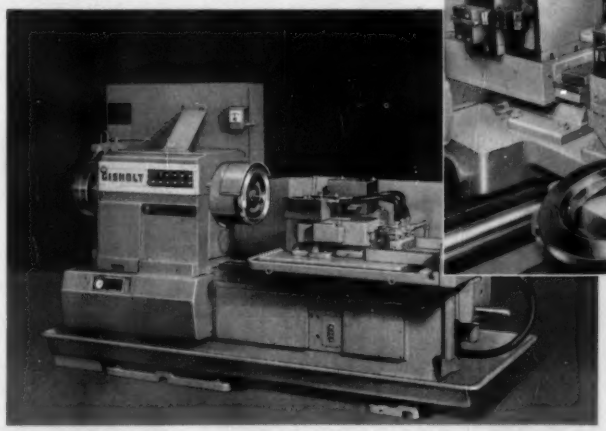
BEVEL GEAR FORGINGS IN 1.75 MINUTES F.T.F. TIME

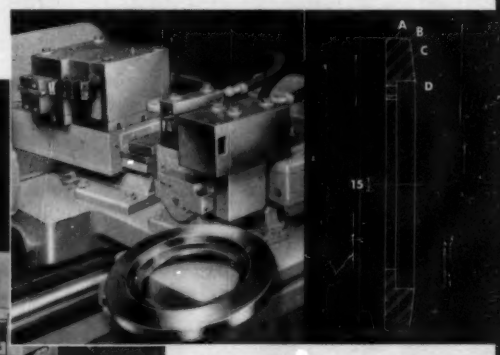
New MASTERLINE Simplimatic does low-cost job

Tough steel bevel gear forgings are a pushover on the new Gisholt Simplimatic Automatic Lathe.

Here's the operation: the part is centralized in the previously machined bore and chucked on the web in a draw-back clamp fixture. The platen table traverses forward, carrying slides and tools into position. The rear slide is set at the proper angle to machine the bevel face C. As the lead tool—held in a separate auxiliary slide—begins to feed, it is cammed to plunge into the face to roughing depth. Then, as slide movement continues, the lead tool feeds across with other rear slide tools following, to machine bevel face C and radius B. At the same time, front slide tools turn A and form radius D. F.t.f. time: 1.75 minutes.

New Gisholt MASTERLINE Simplimatic Automatic Lathe, designed for high-speed automatic machining operations.





Tooling setup for bevel gear job. Both slides have adjustable tops to speed tool setting. Rear slide has swivel base to simplify angular adjustment.

Fully automatic cycle of Simplimatic lets one man do two-man job; reduces f.t.f. time; cuts machining costs.

MASTERLINE GISHOLT SINCE 1887

TIME-SAVING IDEAS

HIGH-SPEED OUTPUT ON VALVE TAPPETS WITH NEW GISHOLT SUPERFINISHER

Fully automatic handling speeds Superfinishing

Superfinished tappet with .005 inch crowned top.

Note cup-shaped stone over piece; pickup arms; ejector assembly and chamfer attachment.

New Gisholt MASTERLINE No. 81 High Production Superfinisher.

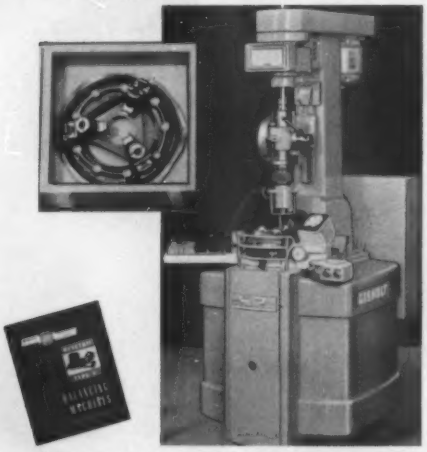
Here's how cast iron valve tappets are handled automatically on the new Gisholt MASTERLINE No. 81 High Production Superfinisher.

Cup-shaped stones are used, rotating off-center to generate a .005" crown on top of each tappet.

These parts are Superfinished from a flat ground surface down to 5 micro inches RMS or less. As each part is completed, a work transfer device with a left and right pickup arm is actuated. The left arm removes a rough part from a feeder conveyor, while the right arm receives the Superfinished part ejected from the spindle. Next, the transfer indexes so that the left arm is over the spindle and the right arm above a discharge conveyor. An ejector assembly pushes the rough workpiece into the spindle—the finished part onto the discharge conveyor. The transfer indexes to neutral, permitting the stone to engage the work. After Superfinishing, the stone retracts; a chamfering attachment operates, and the above cycle repeats. Floor-to-floor time is only 16 seconds per piece.

Superfinishing gives valve tappets longer life; automatic handling cuts costs.

Improved Gisholt Type 1SV1 DYNETRIC Balancing Machine setup for clutch and pressure plate assemblies (inset).



Write for free copy of Form 1165-A, the new Gisholt Type "S" Balancing Catalog.

No. 11-1255
643

LOCATES, MEASURES, CORRECTS, INSPECTS IN SINGLE HANDLING

Gisholt ISV1 DYNETRIC Balancer handles 90 parts an hour

This is an interesting example of how the 1SV1 Balancer cuts costs, by minimizing the motions demanded of the operator.

Here, clutch and pressure plate assemblies are rotated as the operator observes angle and amount of unbalance in the same visual field. One unit on the amount meter represents 1/32" drill depth of a 9/16" diameter drill at the radius of correction. A simple scale on the drill press assures drilling to depth indicated on the meter. Angular location is read on a dial under a stroboscopic lamp.

To correct for unbalance, the operator stops the spindle, positions the part for correction at the observed angle, and lowers the drill. A chip removal tube comes down with the drill and removes chips as they are formed. A thrust device supports the work. After correction, the part is again rotated to assure balance within tolerance. The 90 parts an hour are handled at 80% efficiency.

Equipping a standard balancing machine with simple attachments assures maximum production with minimum effort.

THE GISHOLT ROUND TABLE represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

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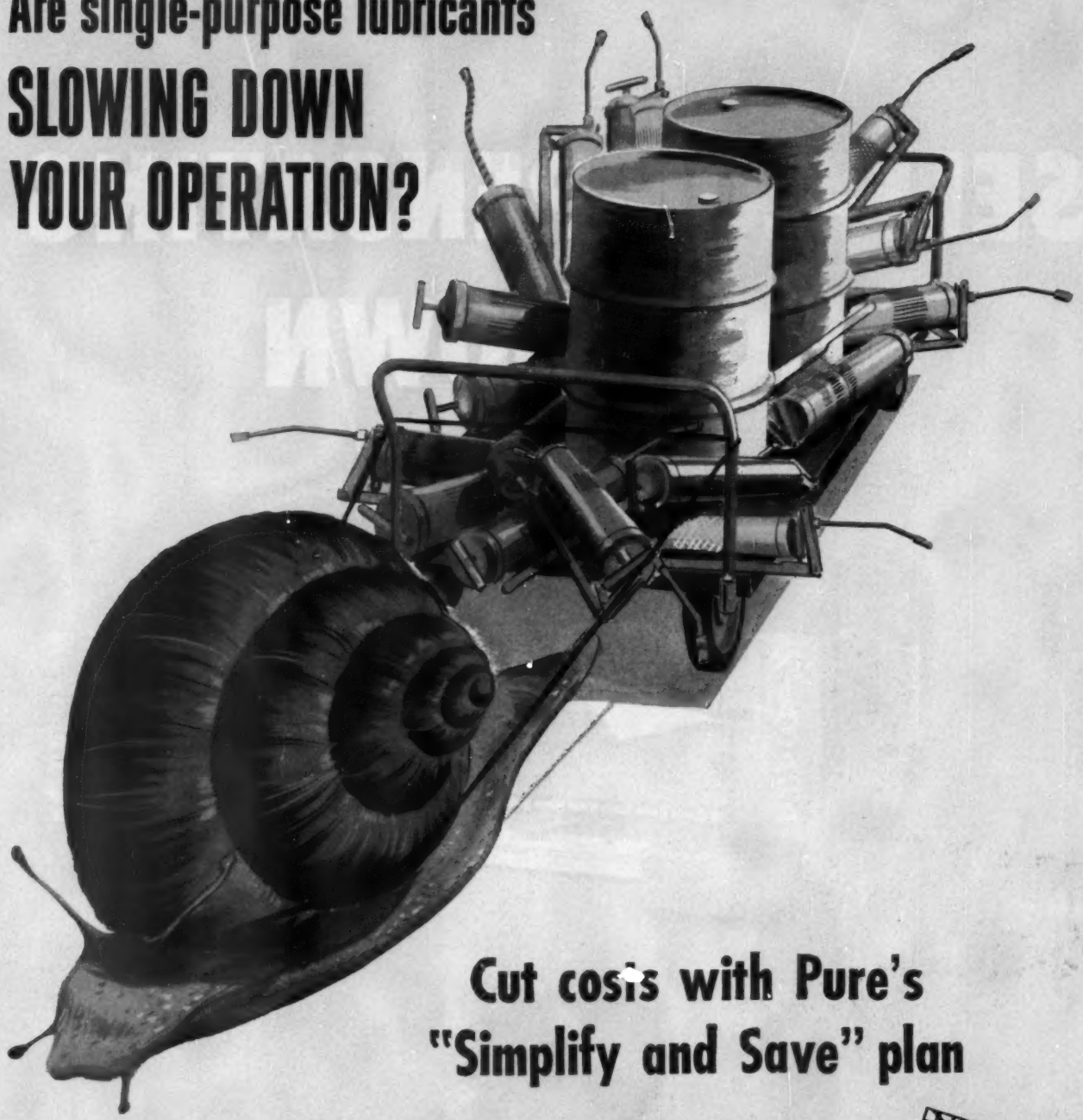
Are single-purpose lubricants SLOWING DOWN YOUR OPERATION?



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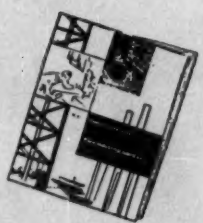
You see, Pure Oil has perfected a line of *multi-purpose* lubricants. In most cases just six of these money-saving lubricants are all you need for your entire plant. Speeds application. Reduces inventory. Minimizes mis-application. Simplifies lubrication and stock control. Streamlines purchasing.

Why not phone your nearest Pure Oil office and see how this simplified plan can cut costs for you. Reverse the charges—and call now.



Free Booklet tells you "How to Simplify and Save". Write The Pure Oil Company, 35 E. Wacker Drive, Chicago 1, Illinois.

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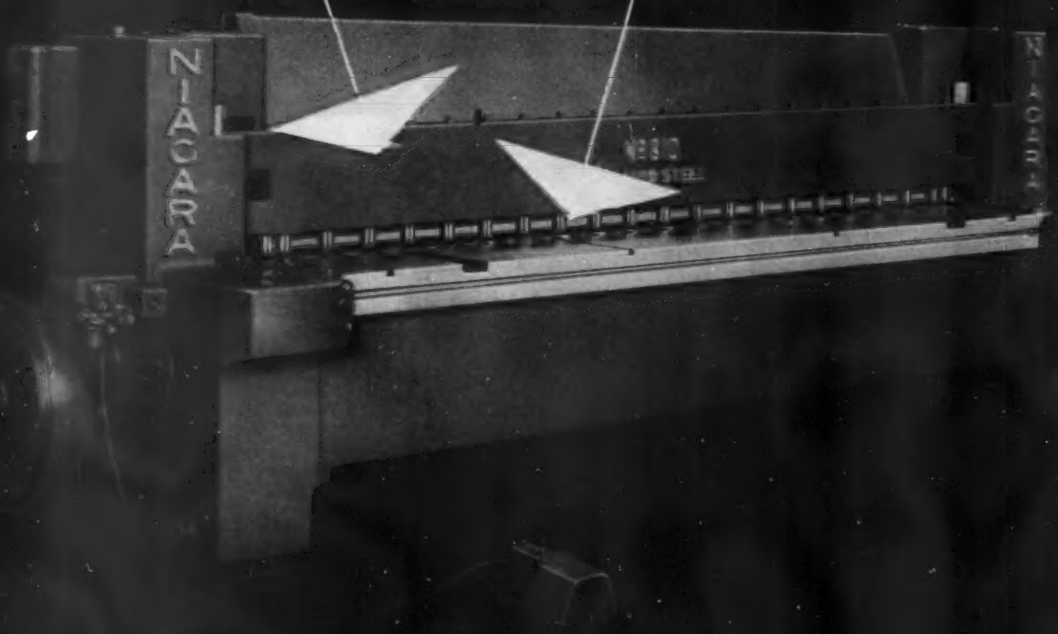

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a BIG FACTOR in the superiority of Niagara Shears

"STRAIGHT-EDGE" CUTTING ACCURACY
Positive, power actuation grips work securely for maximum cutting accuracy.

LOW IMPACT AVERTS DAMAGE AND INACCURACY
Individual pressure feet contact work with low impact, thus safeguarding both the material and bed against damage, as well as reducing noise level. No hammer-blows to mar work. No peening of bed with resulting distortion of knife seat.

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Multiple pressure feet on 6" centers, applying uniform pressure, hold work flat and tight against bed to assure utmost shearing accuracy. No rippling of sheet between feet as cut progresses. Firm grip on short pieces.

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. . . offers contour facing as well as turning and boring . . . particularly suited for turning contours involving diameters connected to faces by curves!

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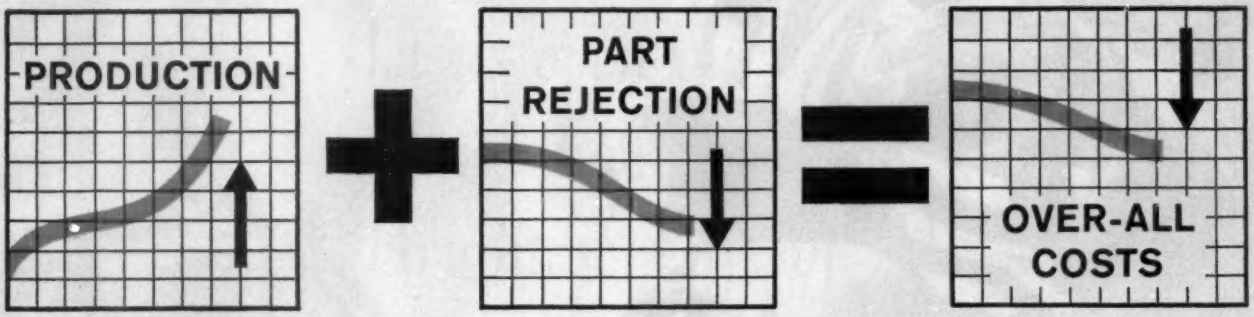
. . . traces in both directions: toward head or tail . . . faces exactly square shoulders . . . maximum versatility and tracing capacity!

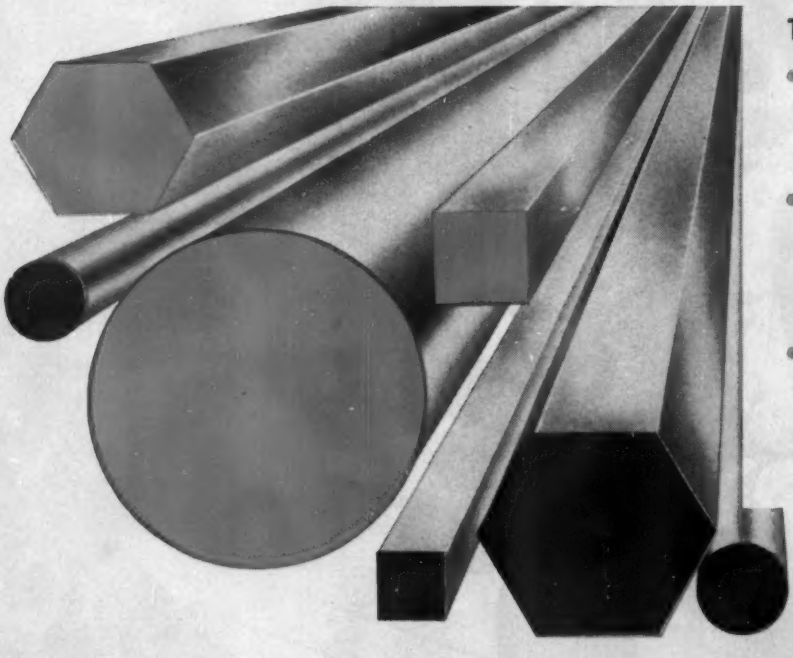
more than ever before . . .
your LODGE-*ical choice is* **Lodge & Shipley**

J&L cold drawn leaded steel bars work to your over-all cost advantage

HERE'S HOW:



...they're free cutting and available in both Bessemer and Open Hearth grades



These versatile steel bars offer:

- IMPROVED MACHINABILITY—because they enable you to use faster cutting speeds, to secure longer tool life and to produce superior surface finishes.
- GREATER UNIFORMITY—because they are completely J&L-produced from the basic raw materials to guarantee optimum uniformity so necessary for today's high-speed machining operations.
- HIGHEST QUALITY—because they must meet the rigid quality standards developed by J&L through years of leadership in the development and production of free-cutting steels.

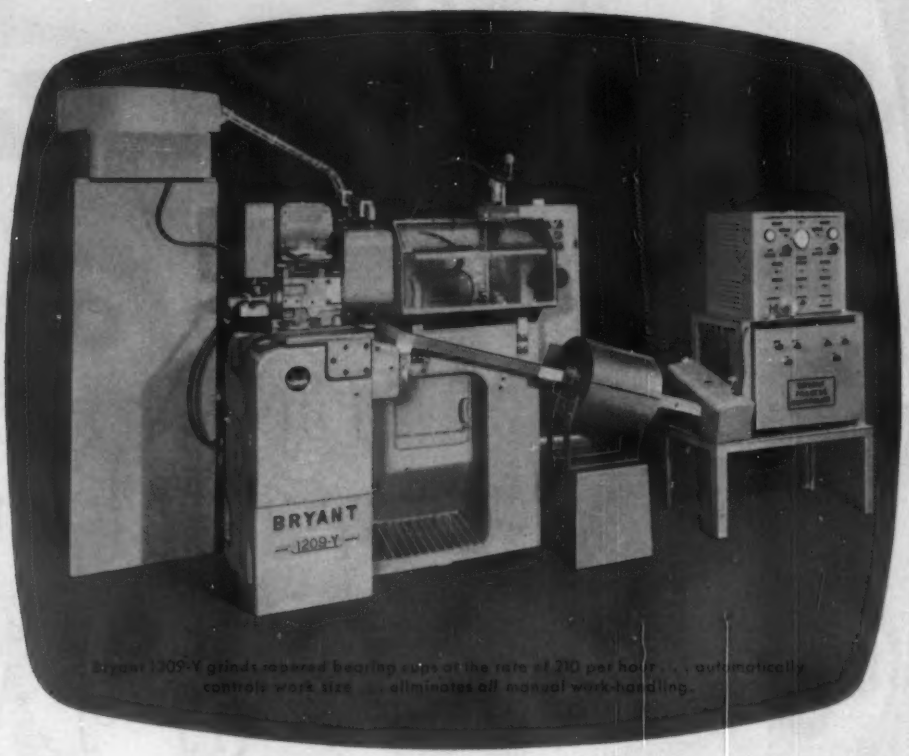
Phone the nearest J&L District office or your Distributor today.

Jones & Laughlin
STEEL CORPORATION — *Pittsburgh*

J&L STEEL

This year...
let us open our hearts
and homes to the
Brightest Gift of All...
The True Spirit
of
CHRISTMAS
MORSE TWIST DRILL & MACHINE COMPANY · NEW BEDFORD, MASSACHUSETTS

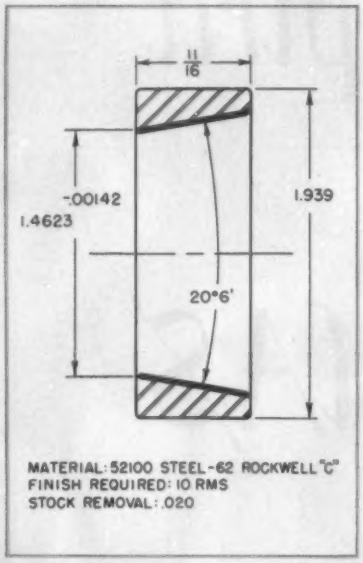
These extra features



Bryant 1209-Y grinds tapered bearing cups at the rate of 210 per hour . . . automatically controls work size . . . eliminates all manual work-handling.

. . . on BRYANT INTERNAL GRINDERS

increase output, improve quality, cut costs!



Need volume production? small lot grinding? toolroom versatility? precision? Bryant grinders help you achieve *all four.* In addition, Bryant special equipment and features enable you to attain even broader flexibility and greater precision in your production.

Look into these Bryant cost-cutting features today . . .

- ***Bryant Process Controller*** — provides automatic statistical quality control.
- ***Bryant Air Sizing*** — provides automatic size control where extremely close tolerances must be held.
- ***Shoe Centerless Grinding*** — speeds up loading and unloading of work and eliminates distortion.
- ***Automatic Work Handling*** — allows integration into automated production lines.
- ***New Series 800 Bryant Hi-frequency Wheelheads*** — supply smooth, trouble-free operation and plenty of power for the toughest grinding jobs, at speeds from 10,000 to 100,000 R. P. M.
- ***Exclusive, adjustable precision alignment features*** — maintain original machine accuracy throughout the life of the machine.

Bryant offers three methods of acquisition: 1) outright purchase, 2) conditional sale (short term or long term), 3) lease.

BRYANT

For literature or more information on Bryant machines, special equipment and financing plans, write:

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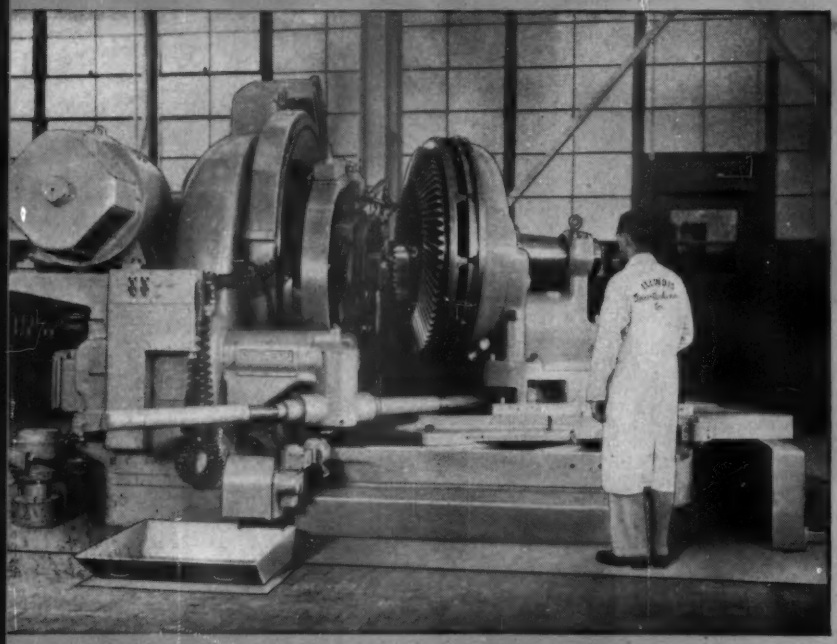
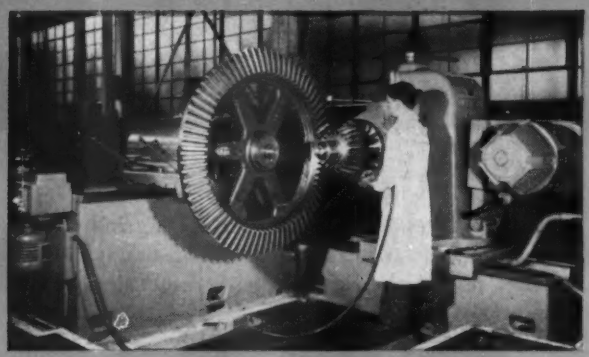
BIG SPIRAL BEVEL ZEROL BEVEL HYPOID GEARS

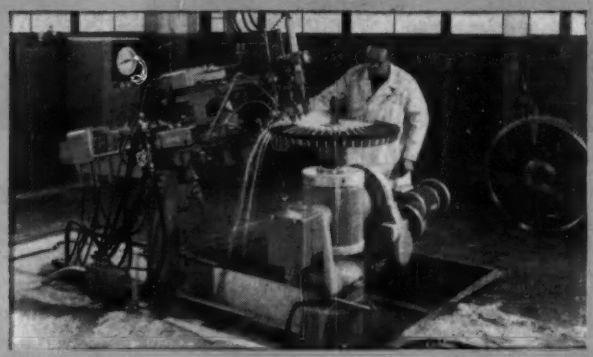


PRECISE GENERATION OF BIG BEVEL GEARS

This new No. 170 Spiral Bevel and Hypoid Gear Generator is the nucleus of the most modern and productive unit of large bevel gear generating machinery in the world. It generates spiral bevel, zerol bevel, and hypoid gears to 72" diameter, 2.875" tooth depth (.75 D.P.), 10" face, and 10" hypoid pinion offset above or below centers. The localized gear tooth bearing, an established necessity for today's heavily loaded gear drives, is precisely controlled to your specifications.



POWER TESTING—This new No. 61 Angular Hypoid Testing machine is the most advanced of its kind. Large spur, helical, herringbone or bevel gears are operated under load at any shaft angle, giving exact inspection of tooth contact under operating conditions. It will efficiently test gears up to 90" diameter and hypoid offsets to 10" above or below centers.



SURFACE HARDENING—This new No. 2 Flame Surface Hardening machine is closely controlled electronically to produce precise, uniformly distortion-free results—it's the all important climax to our large gear production facilities. Spur, helical, bevel and hypoid gears to 120" diameter, .75 D.P., and 18" face are surface hardened in this machine.

Visit our modern plants—see the finest equipped plants in the world—designed to serve you.

Look for this mark IGM *... the symbol on finer gears*

ILLINOIS GEARS Reg U.S. Pat Off.

Gears for Every Purpose ... one gear or 10,000 or more

ILLINOIS GEAR & MACHINE COMPANY

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16 surfaces

...on this Garrison Gear Chuck

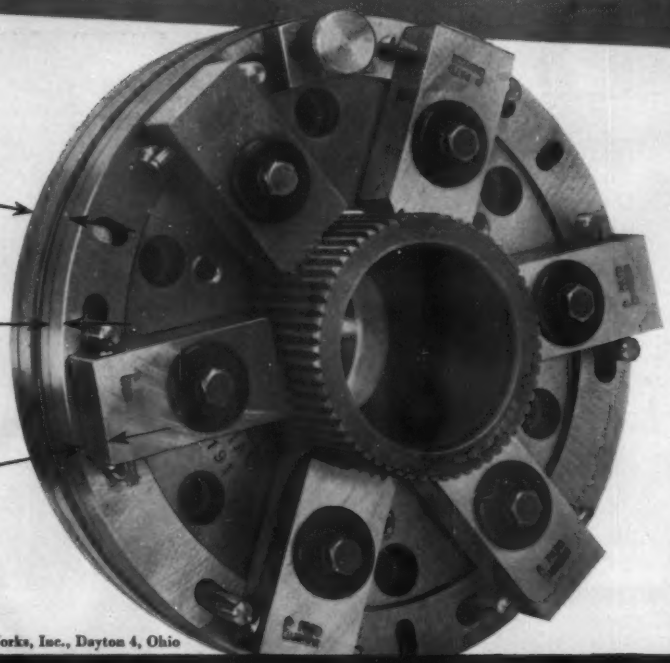


Photo courtesy of Garrison Machine Works, Inc., Dayton 4, Ohio

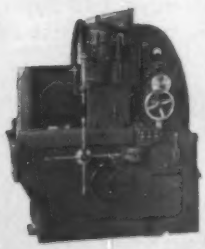
are Blanchard ground for precision

As every machinist knows, machine tools impart their precision through their chucks. That's why chuck dimensions and tolerances are of critical importance . . . and why Blanchard Surface Grinders are commonly used to produce the flat surfaces required.

Blanchard Surface Grinders are ideal for all kinds of precision grinding jobs. They produce extremely close tolerances for flatness, size and parallelism . . . *at low costs and high production rates.* Many Blanchard users grind surfaces flat to within 2 to 4 light bands, parallel to less than .0001", with dimension tolerance of .0002", and surface finish to better than 3 micro inches.

Whether your work involves precision machining or rapid removal of stock, take the advice of master machinists . . .

PUT IT ON THE BLANCHARD



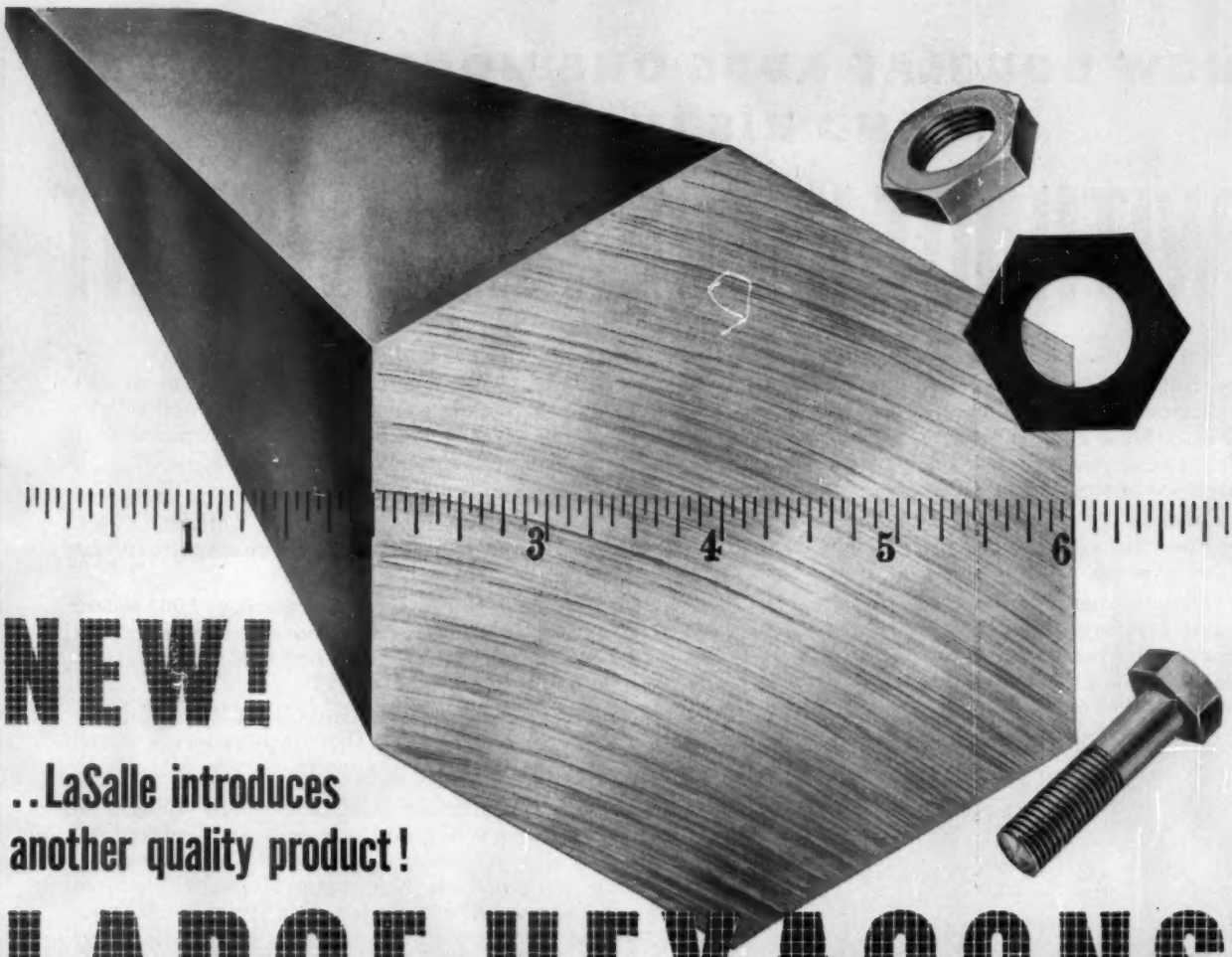
No. 11 Blanchard Surface Grinder

Send for your free copies of "Work Done on the Blanchard", fourth edition, and "The Art of Blanchard Surface Grinding".

PUT IT ON THE **BLANCHARD**

THE BLANCHARD MACHINE COMPANY

64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.



NEW!

..LaSalle introduces another quality product!

LARGE HEXAGONS

available NOW! . . in cold-drawn steel bars (GRADE C 1018) . . sizes to 4"

Yes, you can now buy cold-drawn hexagon steel bars in sizes up to and including 4". Effective immediately, LaSalle offers 3¼", 3½", 3¾" and 4" diameter hexagons . . in addition to conventional sizes ranging from ⅛" to 3".

No longer is it necessary to resort to costly and time-consuming forging, milling or other machining to produce large-size hexagons.

And with *cold-drawn* large hexagons you naturally get the superior mechanical qualities inherent in cold-drawn steel bars. Ask your steel distributor for Large Hexagons by LaSalle.

La Salle STEEL CO.

the Most Complete Line of Carbon and Alloy Cold-Finished and Ground and Polished Steel Bars in America.

For additional detailed information, send for your copy of this helpful new data sheet, "Large Hexagons."

LA SALLE STEEL COMPANY
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Please send me Helpful Data Bulletin No. 14 "Large Hexagons"

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Company_____

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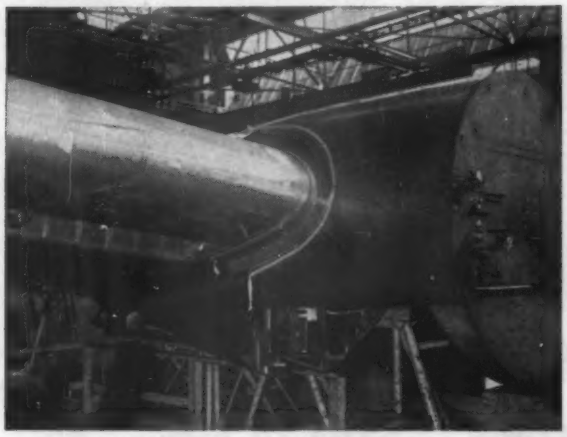
HOW DOUGLAS ADDS ONE MORE PASSENGER AND HIS LUGGAGE...

WITHOUT INCREASING WEIGHT

On the new DC-7 superliner, built by Douglas Aircraft Company, Inc., Titanium is substituted for other metals normally used in nacelle construction. The result is a weight saving, per airplane, equivalent to one passenger and his luggage. And with no sacrifice in strength or safety.

In fact, the strength of Titanium is equal to or greater than alloy steel—yet it weighs only 56 per cent as much.

Douglas uses Titanium sheet for firewalls, structural covering of nacelles aft of firewalls, some frames and the landing gear doors. And if you are interested in facts and figures, here's what they have accomplished with Titanium.



(1) On each of the outboard nacelles of the DC-7, an area of 11,800 square inches of Titanium weighs only 64 pounds, compared to the 68-pound weight of the 8,000 square inches of another metal used in comparable nacelles of the DC-6B.

(2) Each inboard nacelle has 9,300 square inches of Titanium, weighing 55 pounds. On the DC-6B, only 7,600 square inches of another material weighs 64 pounds.

(3) Each set of landing gear doors utilizes 2,000 square inches of Titanium with no increase in weight compared to 1,700 square inches of another metal used on the DC-6B.

(4) A gage for gage substitution of Titanium for another metal in the 11,500 square inches of the four firewalls saves approximately 42 pounds.

Republic is an old hand at this high strength-to-weight business. Over 25 years ago we pioneered the use of alloy steels—then stainless steels—followed by high-strength steels. Now comes Republic Titanium and Titanium Alloys. We offer you years of experience gained through helping hundreds of manufacturers design and re-design their products to get more strength with less weight. And because we make the world's widest range of steels and steel products, we can also offer you recommendations on metals without prejudice.

Mail the coupon for informative literature on how Republic Titanium and Titanium Alloys may be applied to your product.

REPUBLIC ALSO MAKES THESE WEIGHT-SAVING PRODUCTS

ALLOY STEELS REDUCE WEIGHT AND IMPROVE DESIGN. "Beefing-up" to provide a safety factor won't work with moving parts. More weight means more wear—more torque to start—more energy to stop. The answer: Call Republic, world's largest producer of alloy steels. Republic can supply the right alloy to meet your required margins of strength and long life *without excess weight.*

HIGH STRENGTH STEELS PROVIDE PROVED WEIGHT SAVING plus high ductility. Application of Republic High Strength Steels to various products like earthmoving equipment permits weight reduction up to 25%. And when your product is designed and engineered all the way for high strength steel, weight reduction up to 50% is possible. It resists corrosion and extends equipment life.

ENDURO STAINLESS STEEL'S EXCEPTIONALLY HIGH STRENGTH-TO-WEIGHT RATIO and fatigue-resistance permit you to use it in thinner, lighter sections—without loss of strength, without sacrifice of safety. ENDURO resists temperature extremes; holding its strength, toughness, shock-resistance and corrosion-resistance all the way from blistering heat through sub-zero cold. Republic produces ENDURO in all commercial forms.

(Photo courtesy United Air Lines)

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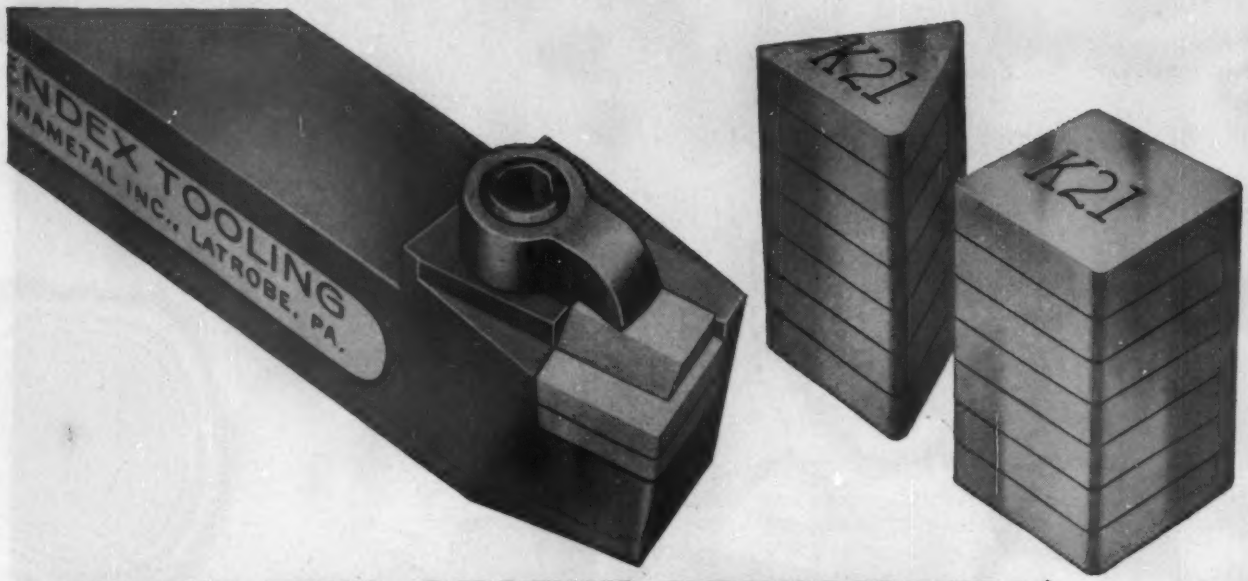


THESE TWO RECENT KENNAMETAL* DEVELOPMENTS HELP TO MEET TODAY'S HIGH-SPEED PRODUCTION NEEDS

The profit advantages of today's high-speed automatic cycling machines for metal cutting are lost when tools wear rapidly—need frequent regrinding—or are cumbersome to index.

Kennametal recently introduced two new developments to help give you continuous machine performance, and to help step up profits in your steel-cutting operations. These developments are Kendex*† Button Tooling and Kennametal Grade K21.

Kendex "turnover" inserts, with replaceable Kennametal shims and new chip control system, double the number of cutting edges, eliminate all regrinding and index in seconds. These features help provide consistent tool performance and hold downtime to a minimum.

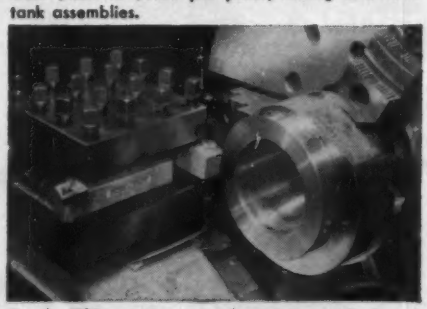
Grade K21 is the General Purpose steel-cutting carbide now outperforming all other medium grades in the carbide industry. Superior performance of K21 is due to exceptionally high edge strength, strong resistance to cratering and superior wear qualities. An extremely versatile grade, K21 can be applied to general steel-cutting, heavy roughing and finishing.

Kendex, in 17 styles and sizes; and K21, in popular blanks and inserts, are immediately available from stock. For their right application on your machining jobs, call a Kennametal Tool Engineer. He works exclusively with Kennametal . . . applying and servicing it. And be sure to ask for reports of Kendex and K21 repeat performances, job after job. KENNAMETAL INC., Latrobe, Pa.

*Registered Trademark †Patent applied for 9403

PROVED BEST—TEST AFTER TEST

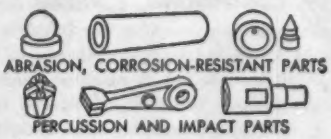
Kendex Tooling with "turnover" inserts cuts tool cost from $1.20 to $0.09 per piece, turning SAE 4140 tank assemblies.



Grade K21—on interrupted cutting, roughed and finished 6 times as many pieces as other premium carbide.

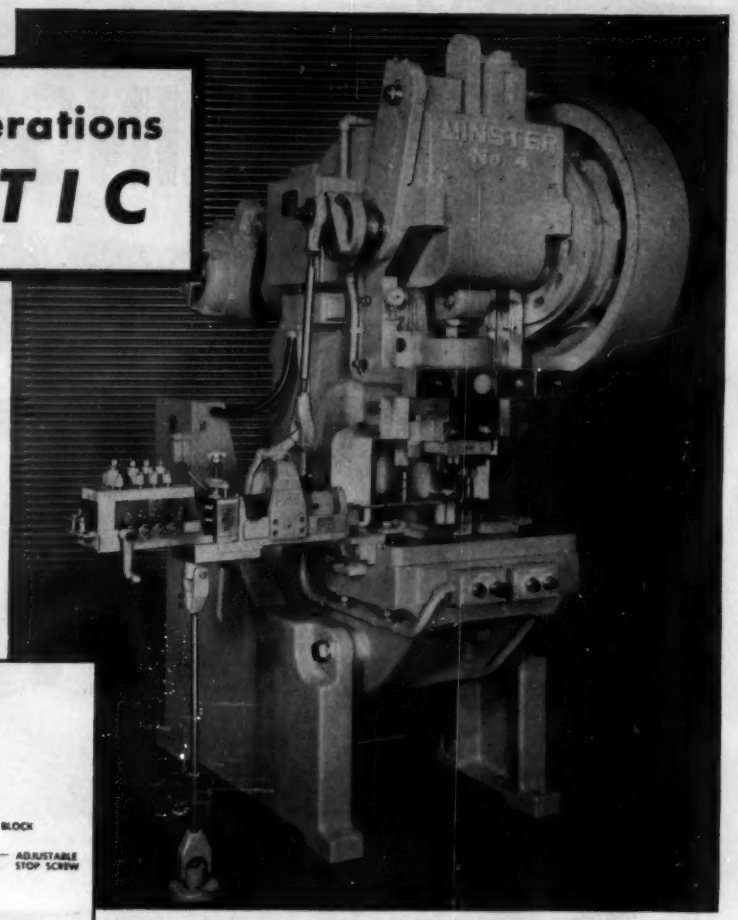
Give your machines the tools they deserve . . . the BEST

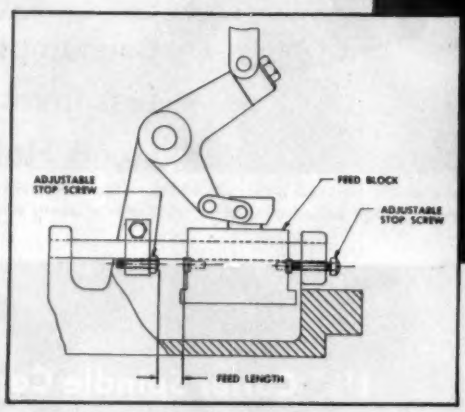
INDUSTRY AND **KENNAMETAL** *...Partners in Progress*



Make Your Press Operations AUTOMATIC

The photo at the right shows an SF-1 U. S. Slide Feed with SS-07 U. S. Plain Stock Straightener (7-roll type) mounted on a No. 4 Minster Press which is equipped with an air clutch and variable speed drive.





The drawing at the left shows how feed length is controlled between positive adjustable stops on the U. S. Slide Feed. This feature assures controlled accuracy of feed length—an especially important factor in progressive die operations.

Cost reduction is of the utmost importance to you. One means of achieving this is through automatic operation. U. S. Slide Feeds are designed and built primarily for the automatic feeding of coil stock into punch presses. By using a U. S. Slide Feed with a Straightener and a Stock Reel or Coil Cradle you can convert your presses into automatic machines.

The use of this equipment gives you the double advantage of increased production and reduced labor costs, plus the feature of flexibility. Within their capacity, U. S. Slide Feeds can be easily adapted to handle materials varying in width, thickness and length of feed. Furthermore, U. S. Slide Feeds are designed so that the length of feed is controlled between positive stops as shown in the drawing, providing consistent accuracy that is especially desirable in progressive die operations.

We are sure that you want to reduce costs and speed output in your press operations. We suggest that you investigate the many advantages of U. S. Automatic Press Room Equipment. Bulletin 80-A gives complete specifications. Ask for your copy.

U. S. TOOL COMPANY, Inc.

Ampere (East Orange) **New Jersey**

Builders of U. S. Multi-Slides—U. S. Multi-Millers
U. S. Automatic Press Room Equipment—U. S. Die Sets and Accessories

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ELMIRA, N.Y.

High Speed Precision MILLING MACHINES

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Too Small for Heavy Duty Millers.

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- Less Investment
- Saves Floor Space

1 1/16" Cutter Spindle Capacity
with 5C Round Hardinge Collet
Eight Spindle Speeds —
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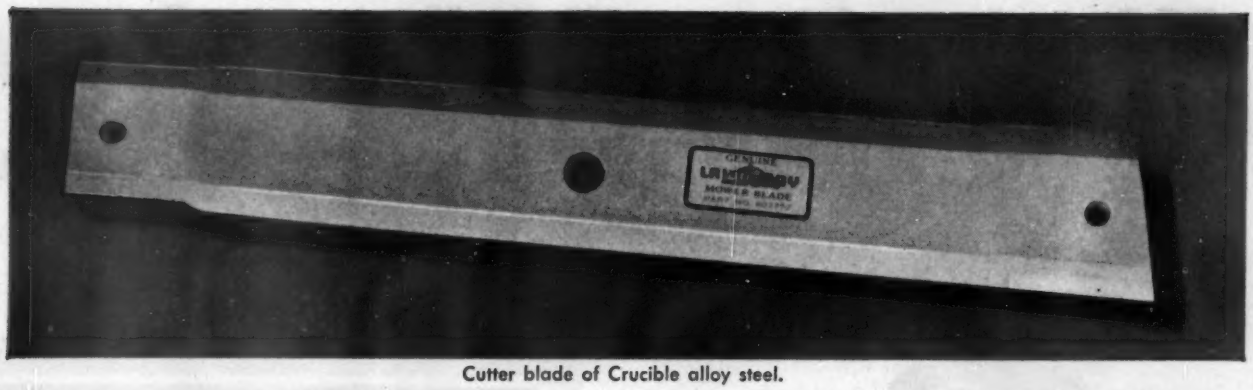
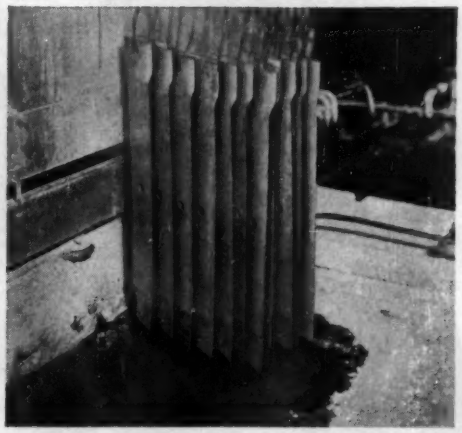


Cutter blade of Crucible alloy steel.

First step in manufacture of cutter blade. Crucible beveled blade alloy steel is fed through this 100-ton press, where it is cut to length and holes punched.



Next, lengths are formed to shape on a hydraulic press, and then given a tempering bath as shown.

CRUCIBLE ALLOY STEEL *cuts blade damage in rotary mowers . . .*

Lawn-Boy mower. Built by RPM Manufacturing Co., Lamar, Mo., a subsidiary of Outboard, Marine & Manufacturing Company, maker of Johnson & Evinrude outboard motors.

Rotary lawnmower cutter blades, whirling at high speeds, often hit small rocks or bits of trash. Ordinary steels just can't take that sort of rugged treatment. They chip, crack – wear out far too quickly. That's why in leading mowers, like the new *Lawn-Boy*, you'll find special *alloy* steel cutter blades *designed for reliable performance.*

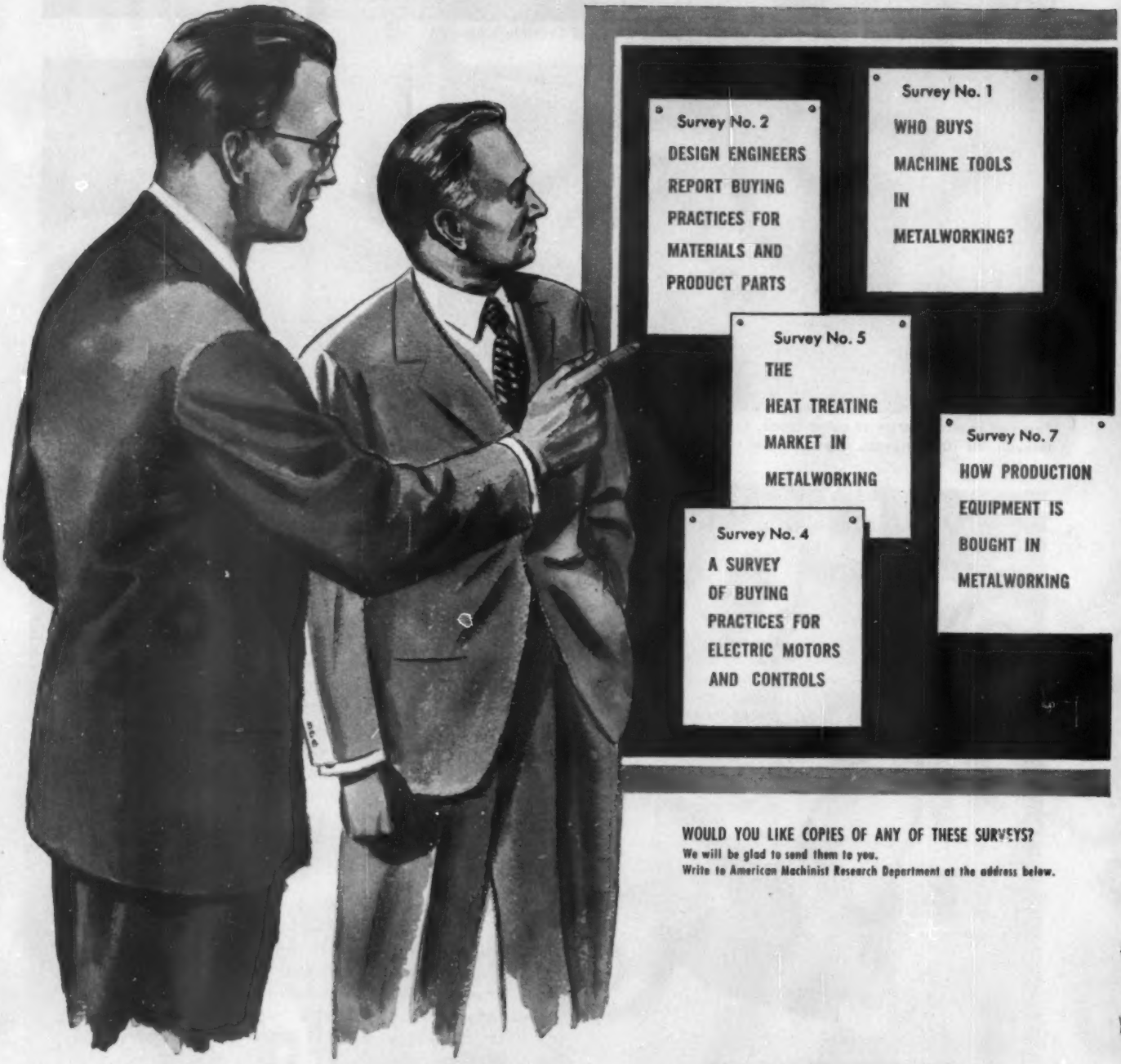
For Crucible has developed a *special alloy steel* made to give the best possible combination of toughness and hardness for long-lasting edges—and formability and ductility for ease of manufacture. It's been so successful that *Crucible is now the largest producer of lawnmower steels.*

Most Crucible steels are designed to fill *special* needs. If you have an application where ordinary steels won't do, come to Crucible. Take advantage, too, of the dozens of technical booklets and data sheets Crucible has prepared to help you make the best use of special steels. For a free publication catalog, write *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

"Metalworking will tell you why PRODUCTION is 'in' on all


Survey No. 1
WHO BUYS MACHINE TOOLS IN METALWORKING?
Survey No. 2
DESIGN ENGINEERS REPORT BUYING PRACTICES FOR MATERIALS AND PRODUCT PARTS
Survey No. 4
A SURVEY OF BUYING PRACTICES FOR ELECTRIC MOTORS AND CONTROLS
Survey No. 5
THE HEAT TREATING MARKET IN METALWORKING
Survey No. 7
HOW PRODUCTION EQUIPMENT IS BOUGHT IN METALWORKING

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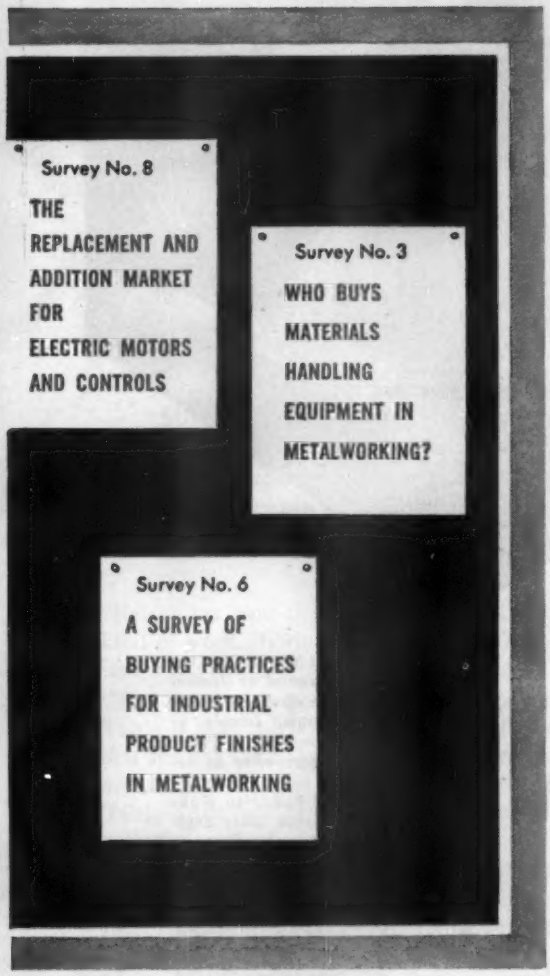
Write to American Machinist Research Department at the address below.

Everybody sells MORE to Metalworking when

its buying"


Survey No. 8
THE REPLACEMENT AND ADDITION MARKET FOR ELECTRIC MOTORS AND CONTROLS
Survey No. 3
WHO BUYS MATERIALS HANDLING EQUIPMENT IN METALWORKING?
Survey No. 6
A SURVEY OF BUYING PRACTICES FOR INDUSTRIAL PRODUCT FINISHES IN METALWORKING

THE QUICKEST WAY to know who in Metalworking influences your products' purchase is to *ask Metalworking.* And throughout this giant industry, the answers will put Production at, or very near, the top of every list.

Purchasing will tell you it buys the machinery Production specifies. *Design-engineering* will report that it seeks Production's recommendations on original equipment above all others. *Corporate Management* will tell you it leaves the choice of types and makes up to Production, generally concerns itself with financial approval only.

Thus, as the eight surveys pictured here typically show, Metalworking is first to recognize the fundamental buying influence of the men who USE and APPLY everything that helps produce, or goes into, the products Metalworking manufacturers. When you think about it, you couldn't expect it to be any other way. What's more . . .

950 American Machinist advertisers will confirm what Metalworking tells you

They confirm it by investing more advertising pages and dollars, for the products used and bought by Metalworking, in this magazine than are invested in any other. They do this because they *know* you must sell Production to sell Metalworking . . . and *American Machinist* delivers far more production-responsible subscribers than any other metalworking magazine in the world.

There's good reason to believe this same formula is a sound one for you. And there's no better time to find out than *now* . . . when *American Machinist's* circulation leadership, and persuasive hold on metalworking production, are at an all-time high.

The McGraw-Hill Magazine of Metalworking Production
McGraw-Hill Building, New York 36
Published Every Other Monday
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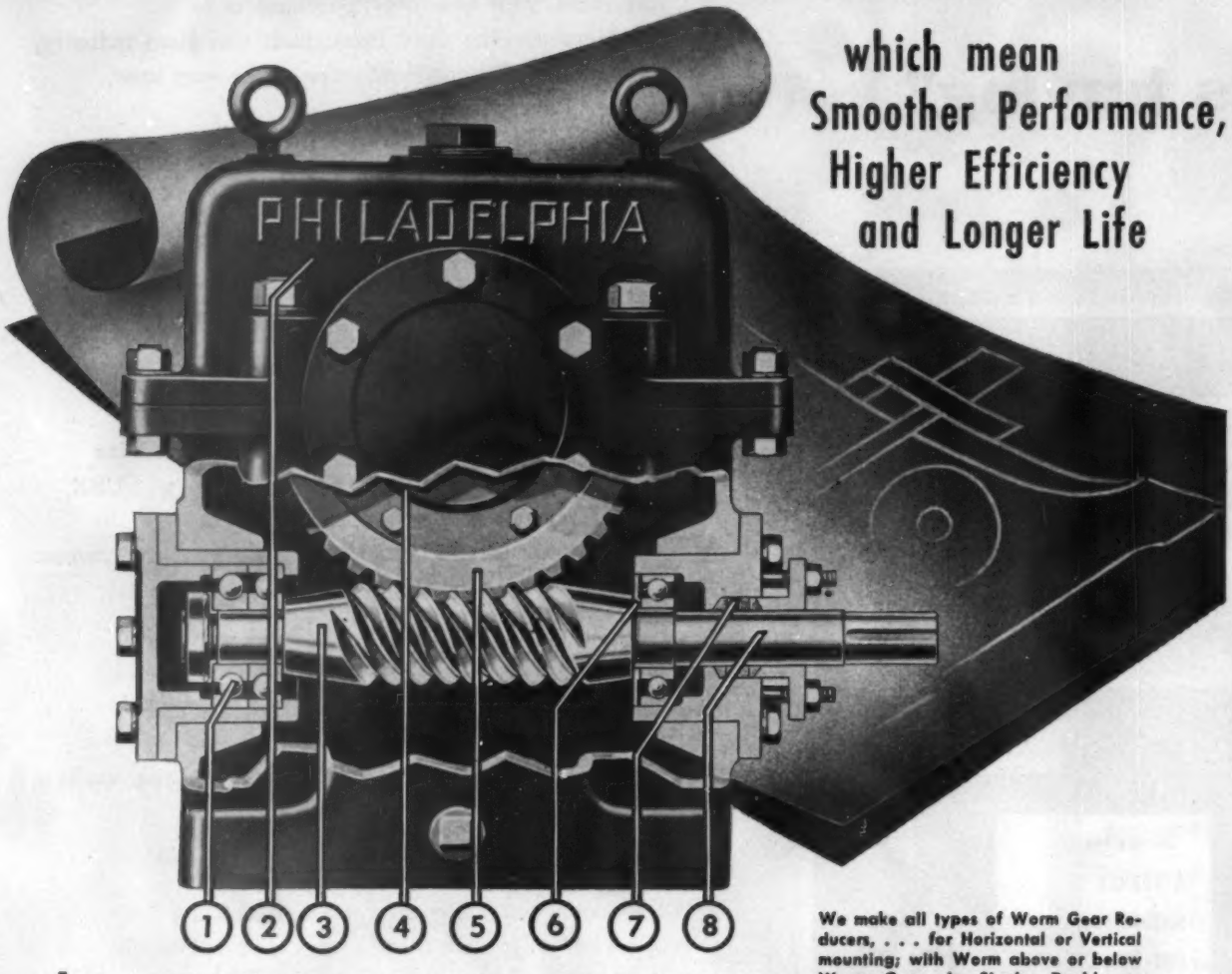
YOU GET ALL THESE ADVANTAGES...

which mean Smoother Performance, Higher Efficiency and Longer Life



1____ **BEARINGS** throughout are of highest quality, calculated to take all loads and stresses in accordance with maximum ratings of units.

2____ **EXCEPTIONALLY RIGID HOUSING** of best grade cast iron . . . Strengthening ribs integral with design.

3____ **WORMS** made of SAE 3115 Steel with carburized and hardened threads. Shaft and threads smoothly ground after hardening.

4____ **GEAR SHAFT BEARINGS** run in an oil well that automatically fills with fresh oil when filled from top. Splash from the gear keeps the wells filled to the overflow point.

5____ **WORM GEAR** made from quality chill cast nickel bronze bolted to a semi-steel center. (Smaller sizes are solid bronze.)

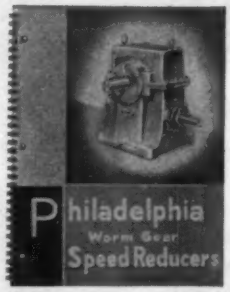
6____ **WORM AND WORM BEARINGS** run in oil bath. Baffle plates prevent flooding.

7____ **WORM SHAFT** equipped with stuffing box to prevent oil leakage.

8____ **SHAFTS** are premium quality. Always accurate, straight, concentric.

We make all types of Worm Gear Reducers, . . . for Horizontal or Vertical mounting; with Worm above or below Worm Gear; in Single, Double or Triple Reductions for medium or heavy duty service; any horsepower or reduction ratio.

Tell us your Speed Reduction problems, and a Philadelphia Sales Engineer will gladly call upon you, . . . without obligation.



Catalog WG-51 sent upon request on your letterhead.

PHILADELPHIA GEAR WORKS, INC.

ERIE AVE. & G ST., PHILADELPHIA 34, PA.
NEW YORK • PITTSBURGH • CHICAGO • HOUSTON • LYNCHBURG, VA.
BALTIMORE • CLEVELAND
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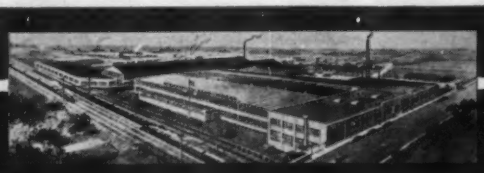


Industrial Gears & Speed Reducers

LimiTorque Valve Controls

Established 1892

Extreme Accuracy ...with a BULLARD Spacer Table

Builders of the P2V5 Neptune Anti-Submarine Aircraft, The Lockheed Aircraft Corporation, have this to say concerning their experience with the Bullard Spacer Table employed to machine a cast aluminum support for the Sonobuoy Chute.

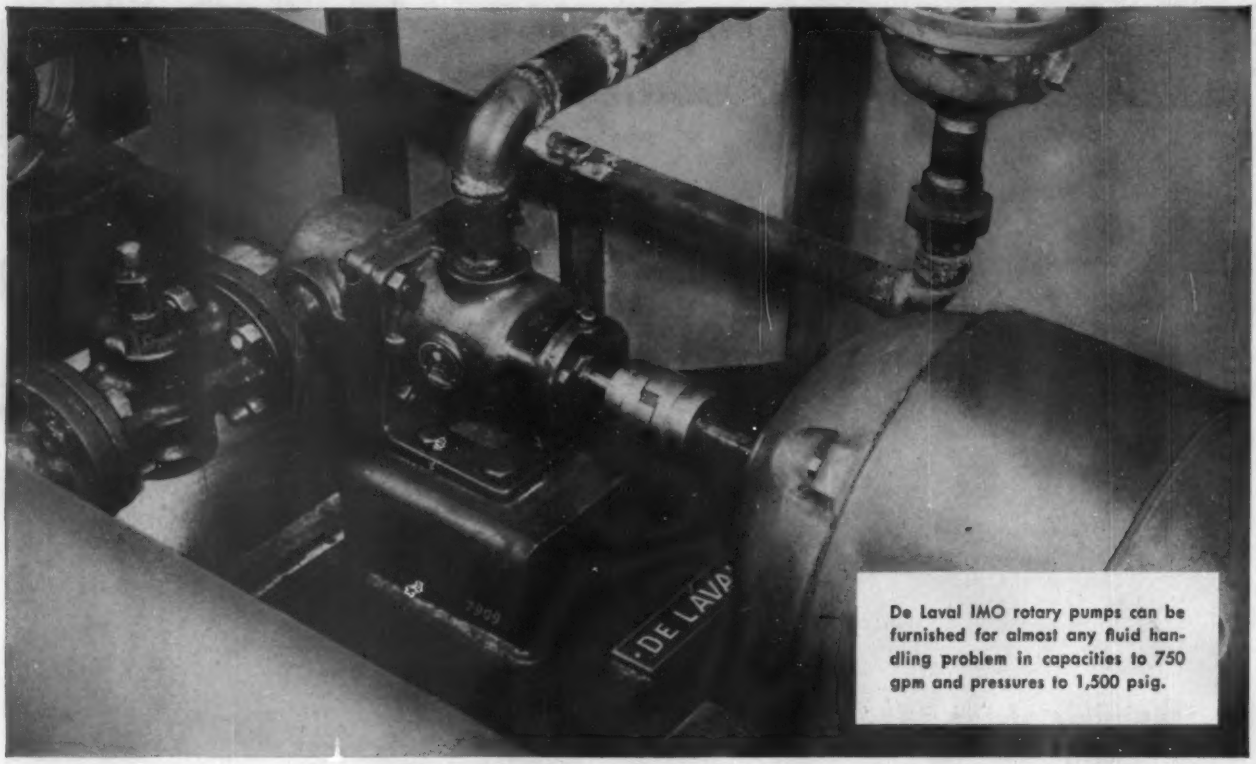
"Before we used the Bullard Spacer Table, we put this kind of work (boring 3 holes of 5.250 diameter) either into a jig or on a horizontal boring machine".

"The reason we put this piece on the Bullard Spacer Table is that the holes are too large for a drill jig and dial spacing for hole location on the horizontal was time consuming. What is more remarkable about the Spacer Table is the fact that it can handle such large diameters with the greatest accuracy.

"Another advantage of the Bullard Spacer Table is the simplified tooling. All we need is a simple holding fixture. The spacing is done automatically by the Spacer Table".

these advantages can be applied to your machining problems. Ask your nearest Bullard Sales Engineer or Distributor or write us for Spacer Catalog

THE BULLARD COMPANY
BRIDGEPORT 2, CONNECTICUT



De Laval IMO rotary pumps can be furnished for almost any fluid handling problem in capacities to 750 gpm and pressures to 1,500 psig.

What to Look for in a Rotary Screw Type Pump

By W. J. MONCON, *Assistant Chief Engineer*
De Laval Steam Turbine Company

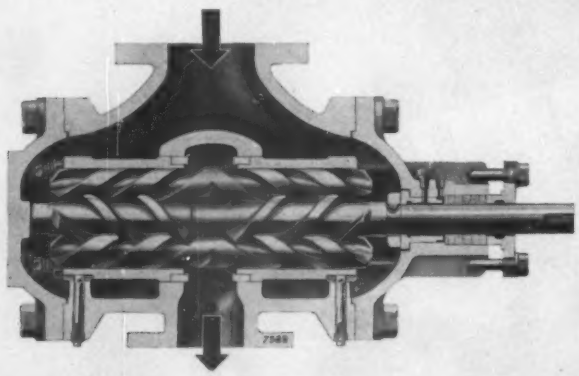
A sound knowledge of design, and how it affects performance, is the best insurance a buyer can have that he will get the pump he needs. This brief analysis of the IMO, a rotary three-screw pump manufactured by the De Laval Steam Turbine Company, will give you some of the necessary facts.

What qualities should you look for in a rotary type pump? It must, of course, meet specified capacities and pressures. But, it must also be efficient, operate quietly, stay on the job.

The axial flow of a screw type pump, and the resulting low inlet losses for any given pump speed, are important benefits that should be considered in making pump selections. The absence of timing gears and other mechanical features of construction also enable the De Laval IMO pump to operate at direct-connected motor and turbine speeds . . . to handle viscous liquids and high suction lifts.

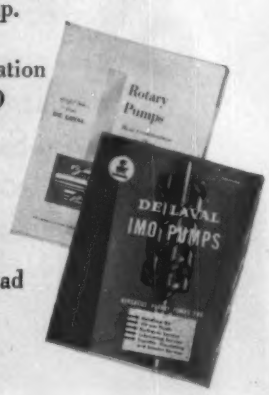
One of the most important features of the IMO pump is the hydraulic turning of the idler or sealing rotors. The central or power rotor is the pumping element; the liquid pumped turns the sealing rotors.

A screw type pump is well suited for applications where pulsation-free flow is desirable. The axial flow of the liquid without trapping and the unique thread form which keeps closures fluid-tight contribute to quiet operation of the IMO pump.



De Laval IMO Series A322A, a positive displacement, rotary screw type pump, can handle capacities to 750 gpm and pressures to 150 psig.

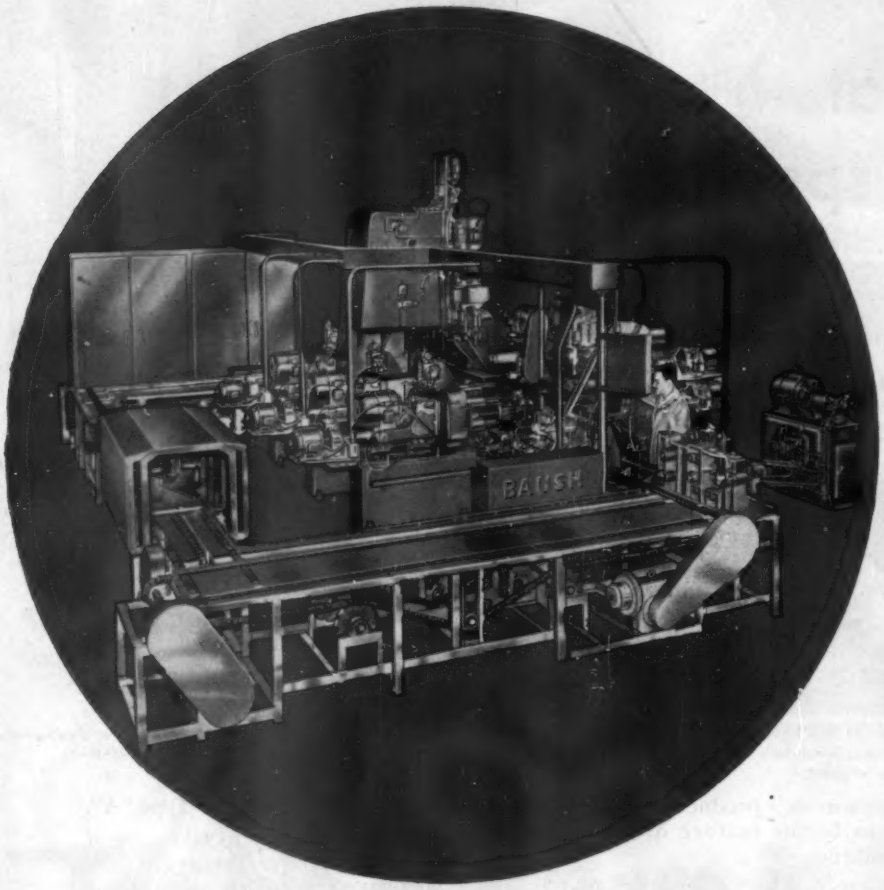
Catalog LS gives useful application and specification data on the IMO pump. An article titled, *Rotary Pumps, Basic Considerations in Their Application*, contains a description of rotary pumps in general. For these publications, write on your company letterhead to De Laval Steam Turbine Company, 887 Nottingham Way, Trenton 2, New Jersey. DL-301



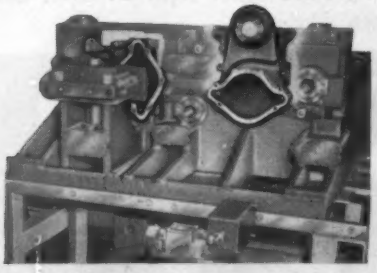
Your Production can be Increased with

BAUSH AUTOMATIC

Multi-Spindle Machine Tools



The Transfer is made up with — 5 Horizontal Model "S" mechanical leadscrew units, one of which is arranged with swivel to raise milling cutter from work • 1 Vertical Model "S" mechanical leadscrew unit • 2 Horizontal hydraulic units • 8 Fixed center heads with a total of 39 spindles • Single bar transfer mechanism • 5 Holding pallets with part held in 2 positions • Pallet conveyor • Electrical controls to J.I.C. Standards • 18 Motors



Automatic machines similar to the one illustrated more than pay for themselves through increased production at lower cost and with far less "down time" resulting from change overs, maintenance, etc.

Baush designed and built this 8-position, 4 station Transfer to drill, counterbore, countersink, chamfer, rough and finish bore, ream, face and turn 60 Chain Case Covers per hour at 100% efficiency for a leading engine manufacturer.

Why not let us show you how to adapt automatic tools and automation to increase your plant production.
There is no obligation in talking it over.

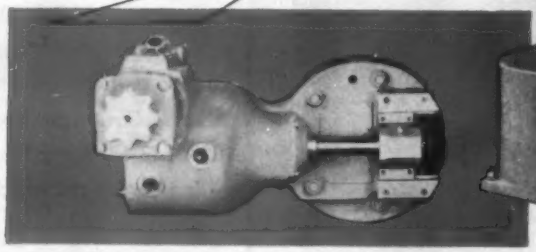
Write, wire or 'phone us — we'll gladly discuss your problems.

BAUSH machine tool co.
SPRINGFIELD 7, MASS.

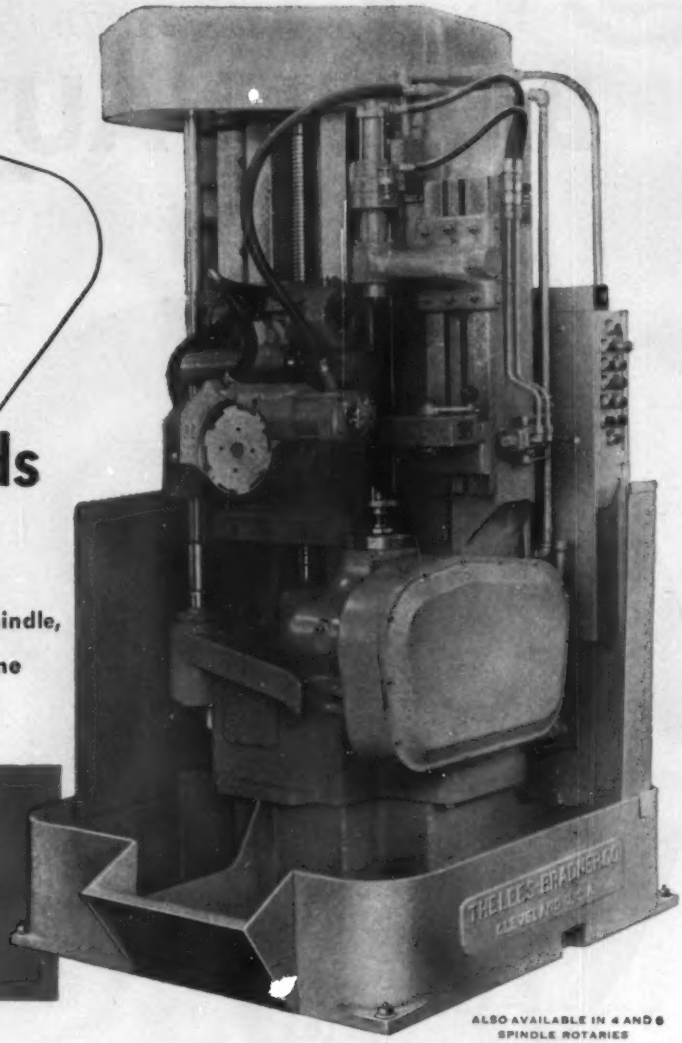
BAUSH

Hob today at tomorrow's speeds

with the new Lees-Bradner Model 7, Type HD Single Spindle, High Speed Hobbing Machine



Close-up shows new, heavier hob head with Timken bearing construction, 3-inch hob shift and new outer support.



ALSO AVAILABLE IN 4 AND 6 SPINDLE ROTARIES

Capacity TODAY to meet tomorrow's production requirements is a built-in bonus feature of Lees-Bradner Hobbing Machines.

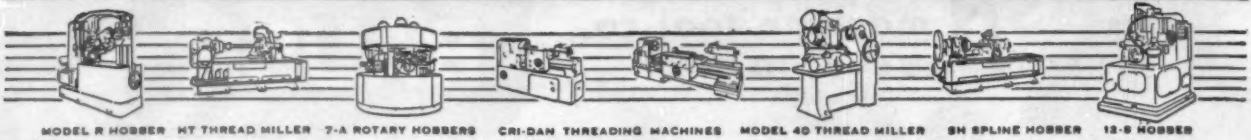
The new Model 7, Type HD Single-Spindle High Speed Hobber for example, is a heavier, faster machine than its prototype. Weighing approximately 1,000 lbs. more, a heavier headstock and heavier column gives you the added rigidity to perform better and faster the excellent job done by its predecessor, the Type "A".

Designed-in production capacity to take care of tomorrow, as well as today, offers savings in time and labor. To industry, constantly pressed for higher production, these savings mean more than dollars. They mean *satisfied customers.*

For the whole story and a demonstration, contact your Lees-Bradner representative. Or, write us direct.

the LEES-BRADNER Company

CLEVELAND 11, OHIO, U.S.A.



MODEL R HOBBER · HT THREAD MILLER · 7-A ROTARY HOBBERS · CRI-DAN THREADING MACHINES · MODEL 40 THREAD MILLER · SH SPLINE HOBBER · 12-S HOBBER

IF YOU THREAD OR HOB . . . GET A BETTER JOB WITH A LEES-BRADNER

What a fight against time Santa used to go through
On the night when his Christmas deliveries were due!

Here's the dependable way he now beats the clock:
Swift ***RAILWAY EXPRESS*** *helps in moving his stock!*

The big difference is

Whether you're sending or receiving, whether your shipment is big or small, and whether it's moving by rail or air—you'll find it pays to specify Railway Express. It makes the big difference in speed, economy, and safe, sure delivery.

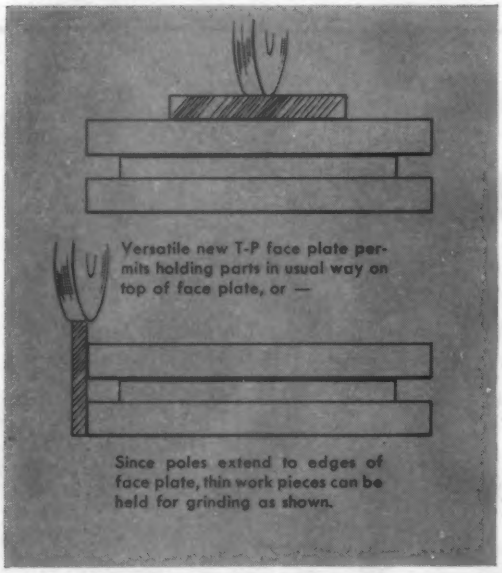
• • •

Railway Express uses the facilities of some 480 independent and competitive transportation companies in the movement of express traffic. It's free enterprise at its best, putting at your service one-third of a million miles of co-ordinated rail, air, water, and truck routes that connect all America.

RAILWAY EXPRESS AGENCY

...safe, swift, sure

New Face Plate on Taft-Peirce Permanent Magnet Chucks


Versatile new T-P face plate permits holding parts in usual way on top of face plate, or —
Since poles extend to edges of face plate, thin work pieces can be held for grinding as shown.

Increases Capacity Simplifies Setups

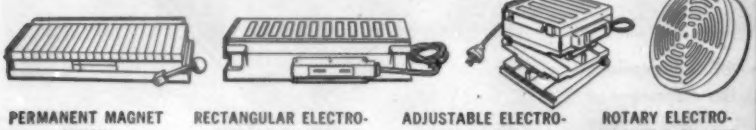
Now lower, longer, and stronger T-P Superpower Permanent Magnet Chucks offer you more surface plate area to work with. Poles extend to edges of face plate to eliminate waste space and dead spots.

15 to 20% lower in height than other Permanent Magnet Chucks, these Superpower Chucks give you more clearance between wheel and chuck.

Since poles extend the full width of face plate, sides of chuck can be used for grinding edges of thin sections. Simplifies complicated setups.

In addition, a Superpower P-M Chuck has more magnetic poles for its size — gives you a greater effective working length.

Extra-sturdy construction assures maximum dependability, minimum maintenance. Now available in a range of standard sizes. Also in sine angle chuck models. Specials on request. Write for more information.



PERMANENT MAGNET CHUCKS | RECTANGULAR ELECTRO-MAGNETIC CHUCKS | ADJUSTABLE ELECTRO-MAGNETIC CHUCKS | ROTARY ELECTRO-MAGNETIC CHUCKS

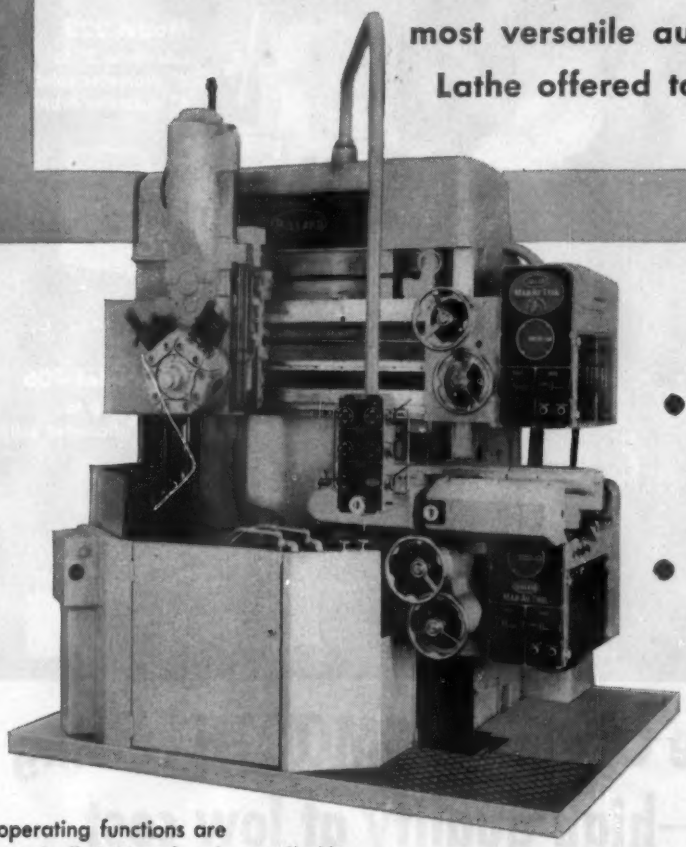
T-P means Top Precision T P

THE TAFT-PEIRCE MANUFACTURING COMPANY, WOONSOCKET, RHODE ISLAND

don't BUY BULLARD *unless* YOU WANT THE BEST!

Yes, Bullard Cut Master, Model 75 with Man-Au-Trol Conversion Unit is the best . . . most versatile automatic Vertical Turret Lathe offered to industry today . . . . .

BULLARD



All operating functions are automatically initiated and controlled by one function control drum and two detector drums in Man-Au-Trol: Table Speeds (20 Available), Feeds (16 Available), Head Travel in feed or traverse, right or left, up or down or 45° in any quadrant and Turret Indexing.

Since the function control drum can be pre-set for a given job in advance, the machine down time for job change-over is reduced to a minimum.

The Man-Au-Trol Conversion Unit can be applied to any or all heads of Cut Master, Model 75 right in your plant.

Your Bullard Sales Engineer will be glad to explain the many other advantages offered by Man-Au-Trol — your best buy in an automatic vertical turret lathe — call him or write for our new catalog.

THE BULLARD COMPANY

286 Canfield Avenue • Bridgeport 2, Connecticut

Please send me a copy of the NEW MAN-AU-TROL, MODEL 75 CATALOG

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COMPANY_____ POSITION_____

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Campbell Abrasive Cutters

ACCO products

CAMPBELL Abrasive Cutting is SMOOTH cutting —high quality at low cost

These CAMPBELL features will save you money

- **Eliminate annealing cost when cutting forged sections from bar lengths**
- **No added cost for smoothing operations**
- **Cutting accuracy reduces scrap losses**
- **Metal can be cut in practically any condition**

• Almost any type of material, whether hard or soft, can be economically cut by CAMPBELL Abrasive Cutters. The excellent finish obtained eliminates milling or other finishing operations in most cases.

Testing procedure by CAMPBELL Engineers will show conclusively which abrasive cutting machine will do the most economical job on your cutting application. Latest type CAMPBELL machines are available to save you time and money on every type of cutting operation.

Let us send you Bulletin DH-301 on "Principles of Abrasive Cutting"

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Campbell Machine Division
AMERICAN CHAIN & CABLE
923 Connecticut Avenue, Bridgeport 2, Connecticut

Wet and Dry Cutters and Nibblers

... make tracks

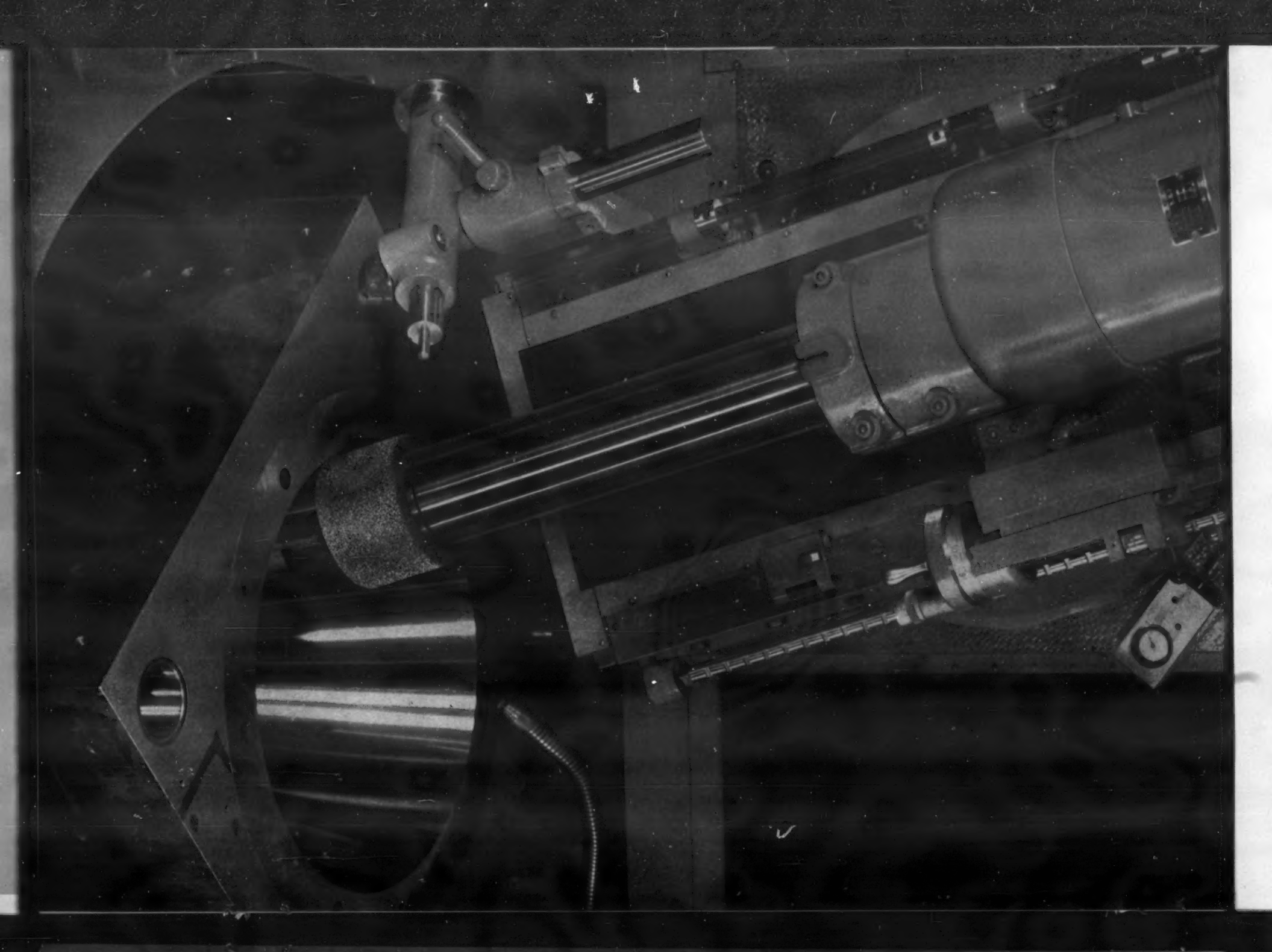
TO YOUR

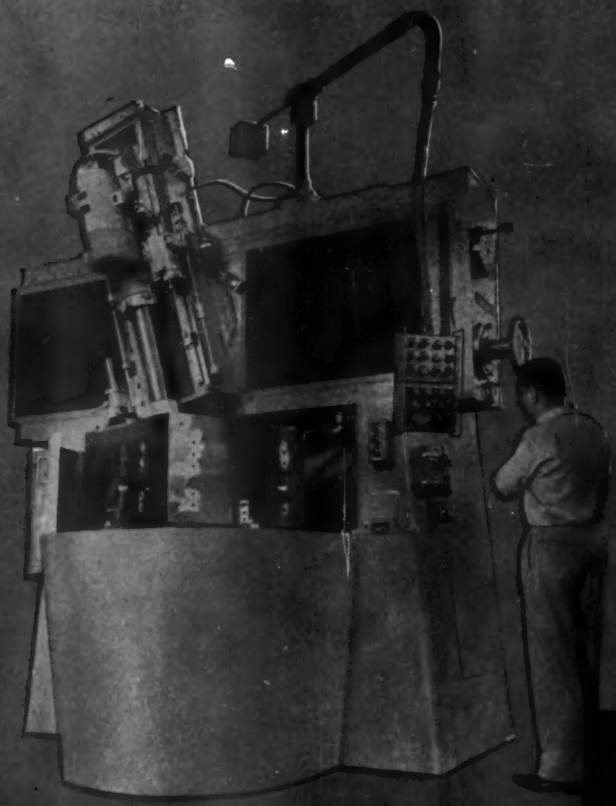
Threadwell

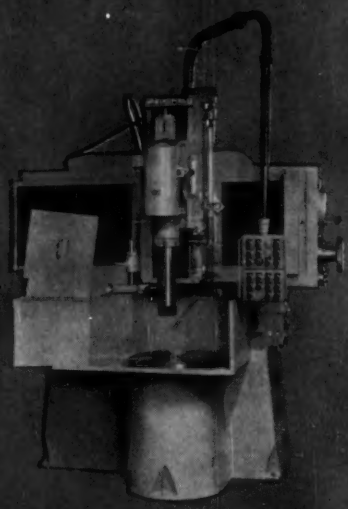
DISTRIBUTOR

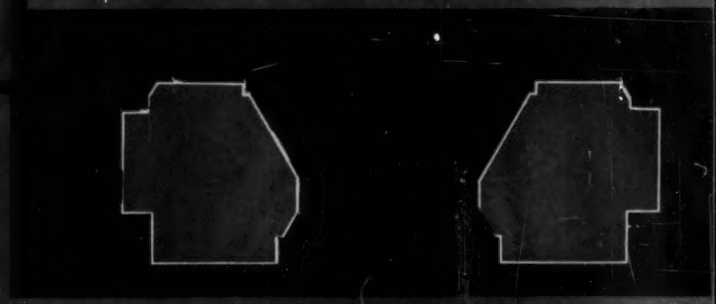
FOR THE FINEST IN
CUTTING TOOLS AND GAGES

Made by THREADWELL, Greenfield, Mass.









one setup: nine jobs

As flexible, as responsive as a dentist's drill, a Springfield Vertical Universal Grinder can reach around and into a workpiece to do nine different jobs on one chucking.

If you make a pipeline valve, a mold, a bearing race—requiring micro-inch finish on any or all the faces shown in the diagram—at whatever angle—look into Springfield. These grinders cut down the number of set-ups, frequently eliminate hand-lapping, operate with fewer work-holding devices. And, as a bonus, on jobs calling for extreme concentricity, one angle setting of the Springfield head grinds both faces of mating parts.

All three models readily adaptable to special problems.

Vertical Universal Grinders: swings 18", 24" and 42".

Lathes: Engine and tool room, contouring and reproducing—swings 14" to 32".

68TH YEAR OF BUILDING IDEAS INTO MACHINE TOOLS

CINCINNATI RIGID SHAPERS

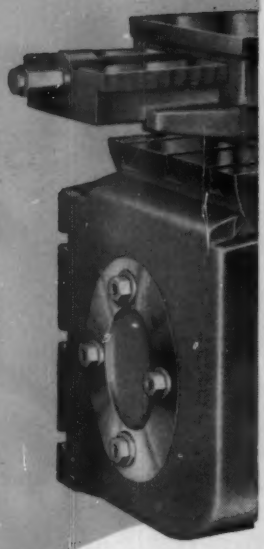
New—modern—these Rigid Shapers offer faster, more convenient controls, greater accuracy, greater dependability. The New nodular iron ram, trunnion and vise, and wide heavily ribbed column give a new rigidity—increase accuracy in cutting.

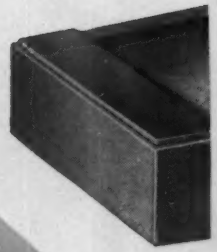
The New slot-free ram also eliminates the manual clamping of ram adjustment—a time saving feature.

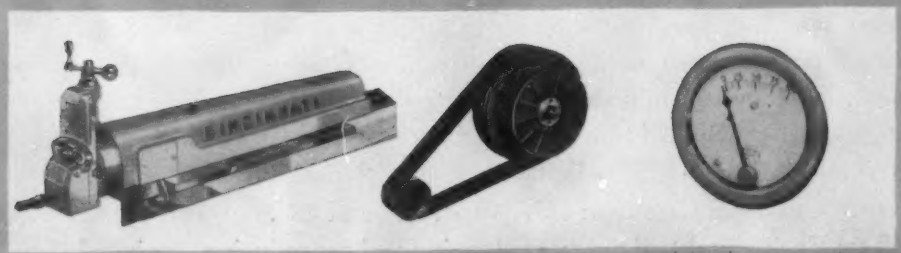
A speedy, dependable electro-magnetic brake and clutch insure a faster performance.

50 P.S.I. pressure lubrication, exclusive on Cincinnati Shapers, is a real insurance against wear and a guarantee of long trouble-free performance.

Write for the circular on the New Rigid Shapers.



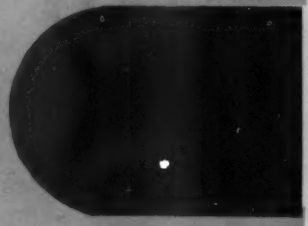


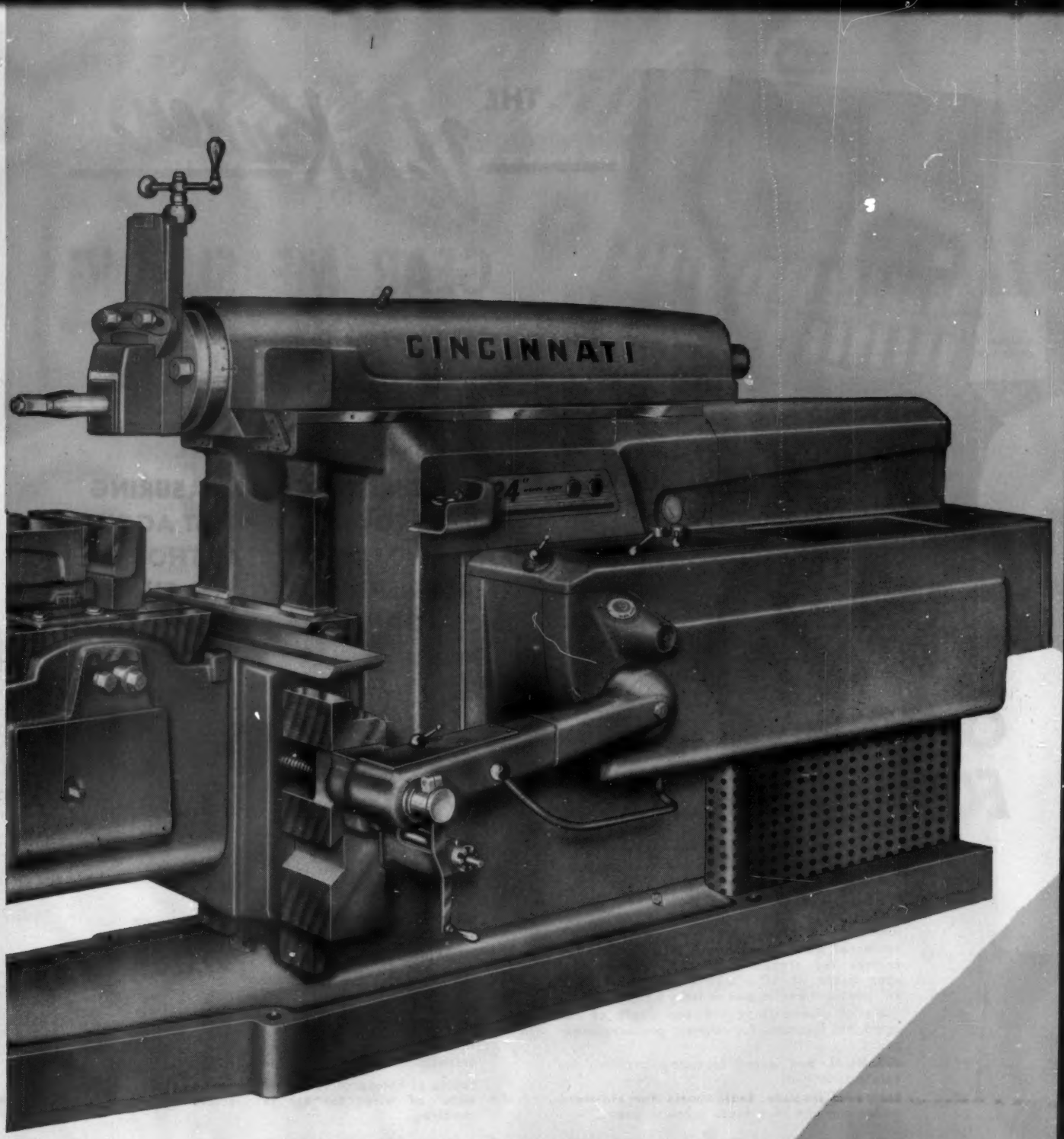


Modular iron, slot-free ram

Electro-magnetic Clutch and Brake

The only shaper with 50 P.S.I. lubrication





Cincinnati Shapers, Shears and Press Brakes carry a 5 year guarantee on workmanship and material—write for details.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO, U.S.A. SHAPERS • SHEARS • BRAKES

CINCINNATI

THE Van Keuren GEAR MEASURING SYSTEM

Set 26EX—Gear Measuring Wires, accurate to ± .000025", for common diametral pitch external spur gears.

VAN KEUREN GEAR MEASURING WIRES PROVIDE THE MOST ACCURATE AND LOW COST METHOD OF MEASURING THE TOOTH THICKNESS OF SPUR AND HELICAL GEARS, INVOLUTE SPLINES AND INVOLUTE SERRATIONS.

ONLY... EQUIPMENT NEEDED:

1—SET VK MEASURING WIRES
1—MEASURING INSTRUMENT

Complete information regarding the use of Gear Measuring Wires is contained in a 50-page section of the Van Keuren CATALOG and HANDBOOK No. 36. Included in this section are:

- **. . . table of wire sizes for the 1.92", 1.728", 1.68" and 1.44" series.**
- **. . . tables of wire measurement including change factors for standard external and internal spur gears of 14½°, 17½°, 20°, 25°, and 30° pressure angles and of from 5 to 500 teeth.**
- **. . . table of relationships between depth of cut and tooth thickness for common pressure angle gears.**
- **. . . definitions and exact formulas covering involute spur gears.**
- **. . . tables of involute tooth parts for standard addendum and stub tooth involute gears.**
- **. . . information, formulas and examples regarding the wire measurement of helical gears.**
- **. . . information and examples concerning the wire measurement of enlarged pinions and reduced gears.**
- **. . . tables of wire measurement for involute splines.**
- **. . . tables of wire measurement for involute serrations.**
- **. . . tables of comparative measurement over three sizes of wires for use in involute profile checking.**

Send for a copy of the new 258-page Van Keuren Catalog and Handbook No. 36 containing valuable technical and engineering information on measuring problems and methods. Address:

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36th YEAR

THE Van Keuren CO.,

173 WALTHAM STREET, WATERTOWN, MASS.

Optical Flats . . . Light Wave Equipment . . . Light Wave Micrometers . . . Gage Blocks . . . Wire Type, Taperlock and Trilock Plug Gages . . . Master Setting Disks . . . Thread Measuring Wires . . . Gear Measuring Wires . . . Carbide Plug Gages . . . Laps and Surface Plates . . . Precision Lapping Service.

on an *Acme-Gridley*

FULLY AUTOMATIC BAR TYPE TURRET LATHE

you can machine this finger-holder spool in 3 minutes

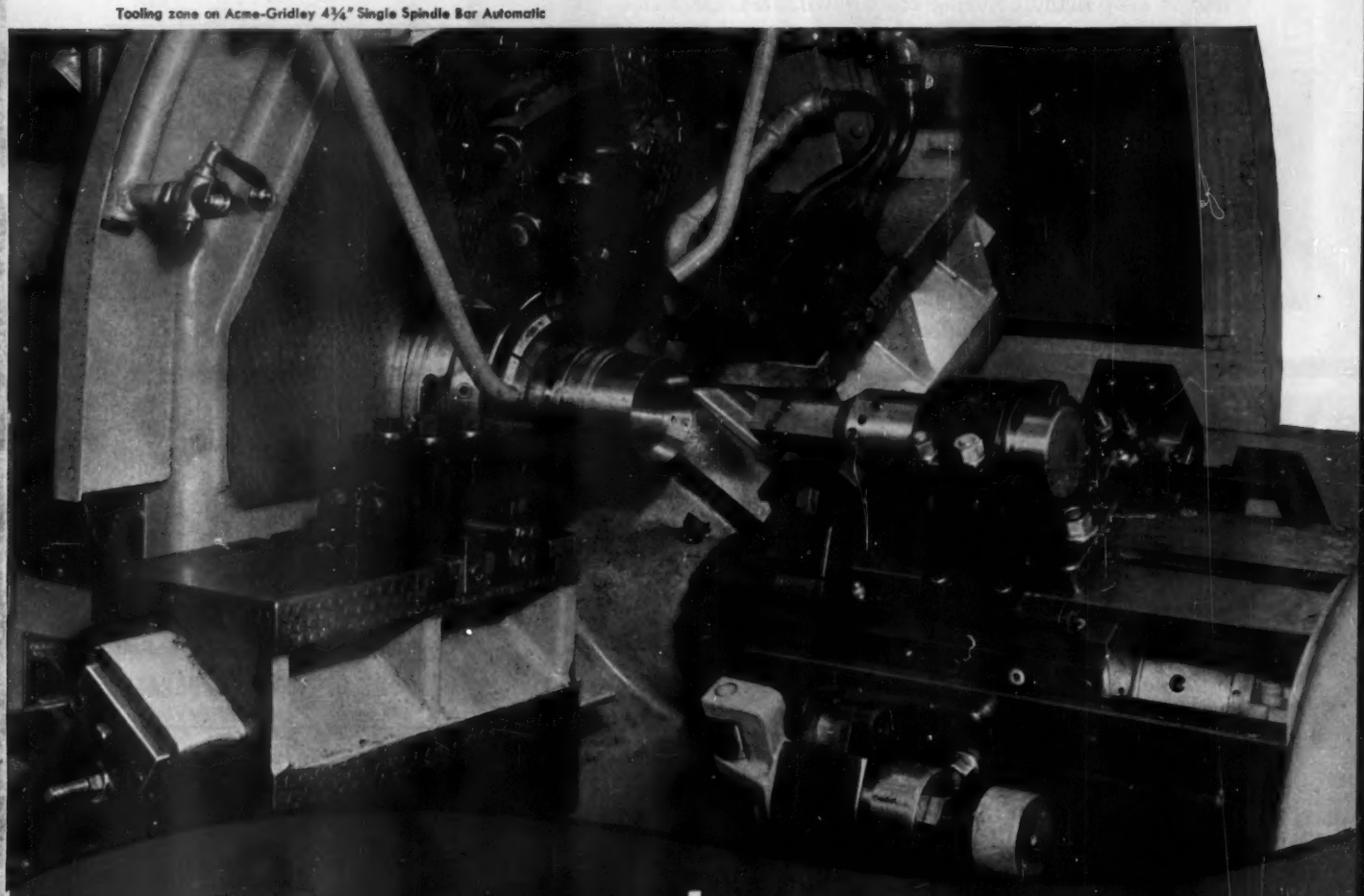
... and do it all day long!

Material—4620 Steel Tubing
Machine Time—3 Minutes
Number of Operations—15, including angular turning attachment; carbide tooling throughout.

Here's the answer: Dependable, automatic control of the work cycle . . . production is always at the same predetermined rate. Also, on the ACME-GRIDLEY Single, you complete more operations on the primary tooling setup—the best way to get greater accuracy, save time and save floor space. *And* one man can operate two or more machines, depending upon the cycle time of the work involved.

Why not learn more about the machine that made such a big hit at the Machine Tool Show? Get the full details in Catalog M-50A . . . then you'll *want* to discuss your production with a National Acme engineer.

Tooling zone on Acme-Gridley 4¼" Single Spindle Bar Automatic



the National Acme company

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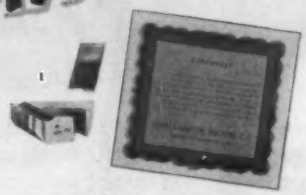
HOW TO "GUARANTEE A GUARANTEE"

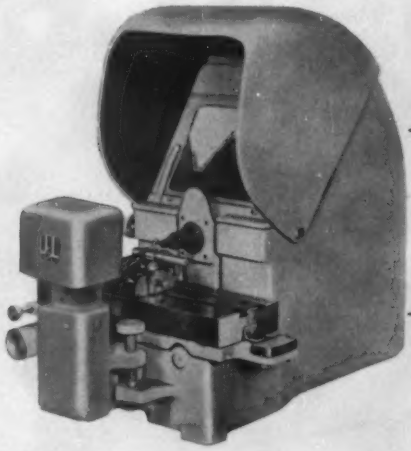


Every set of Jones & Lamson Die Head chasers carries this full guarantee: *to produce Class III threads, or better, across the board.* To insure this guarantee, and to keep manufacturing costs down, J&L carries on successive interoperation inspections the positive way, with Jones & Lamson Optical Comparators.

(We practice what we preach)

Avoid costly work on scrap—
Prove machining results before subsequent operations

Controlled quality means lower costs. Use J&L Comparators on *your* production line . . . their versatility is unlimited.



Write Dept. 710 for information on Comparators and/or Jones & Lamson Thread Tool Products.

FREE!

Dovetails of chasers are straddle milled. Tolerances checked on
The J&L OPTICAL COMPARATOR

Mill angle on front end of chaser. Length and angle checked on
The J&L OPTICAL COMPARATOR

Dovetail angle milled. Angle and centerline checked on
The J&L OPTICAL COMPARATOR

Ratchets for spacing are milled. Chaser length, ratchet form and spacing checked on
The J&L OPTICAL COMPARATOR

Back chamfer is milled. Angle and flat checked on
The J&L OPTICAL COMPARATOR

After heat treating, dovetail is ground. Angles, flats and depth inspected on
The J&L OPTICAL COMPARATOR

Grind thread form. Thread form, angles, root, crests, spacing, lead and helix checked on
The J&L OPTICAL COMPARATOR

Chamfer ground as specified. Angle and amount below root checked on
The J&L OPTICAL COMPARATOR

Top rake ground. End grind and point height checked on
The J&L OPTICAL COMPARATOR

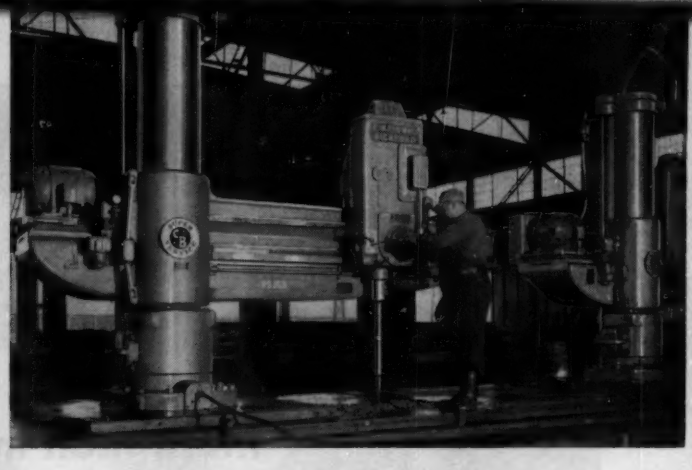
JONES & LAMSON

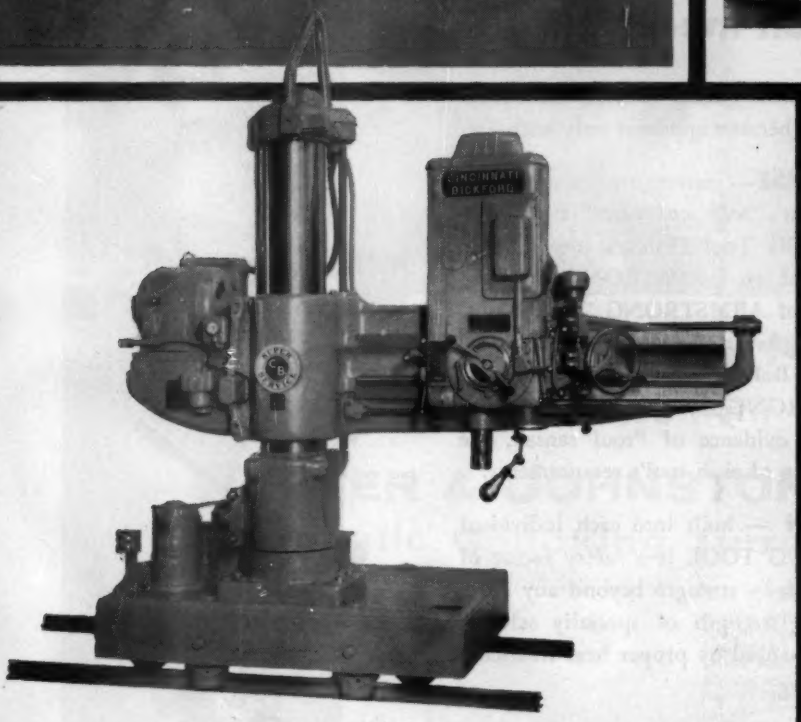
World's largest manufacturer of Optical Comparators since 1919

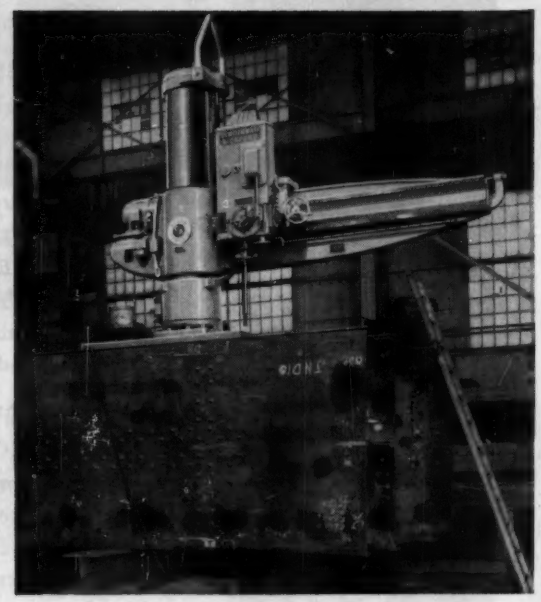
JONES & LAMSON MACHINE CO., 502 Clinton St., Dept. 710, Springfield, Vt., U.S.A.

OPTICAL COMPARATOR DIV.

MOVES that save you money





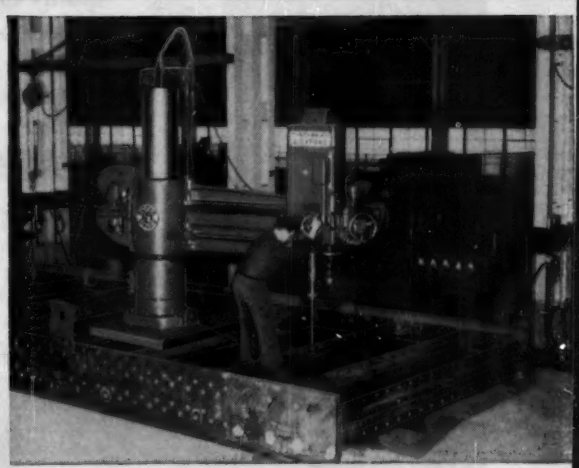


...on the large job!

These portable Cincinnati Bickford Super Service Radial Drills are effecting very large savings, up to 75% on work shown here. It is faster, more accurate and costs less to move the machine, instead of moving the work. Equipped with lifting bail, these machines are so perfectly proportioned and balanced that they need no clamping to work or floor. They do not tip or rise up while drilling.

Inquire about these portable machines—track type, sliding saddle on bed, or merely with stub base and lifting bail—they can save time and dollars for you.

Write for Bulletin R-29.



CINCINNATI
BICKFORD

RADIAL AND UPRIGHT DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO.

Cincinnati 9, Ohio, U.S.A.

Subsidiary of GIDDINGS & LEWIS MACHINE TOOL CO. : Fond du Lac, Wisconsin

ARMSTRONG

Quality TOOLS

More than meets the eye

There are extra values in ARMSTRONG TOOLS that become apparent only with use.

TOOL SENSE— convenience in use — the most efficient *"tool approach"* built into ARMSTRONG Tool Holders; the balance and *"feel"* of an ARMSTRONG Wrench; the *rigidity* of ARMSTRONG "C" Clamps; the extra *toughness* of ARMSTRONG Lathe Dogs and Eye Bolts; the universal *adaptability* of ARMSTRONG Set-up and Hold-down Tools — the evidence of "tool sense", the understanding of each tool's requirements.

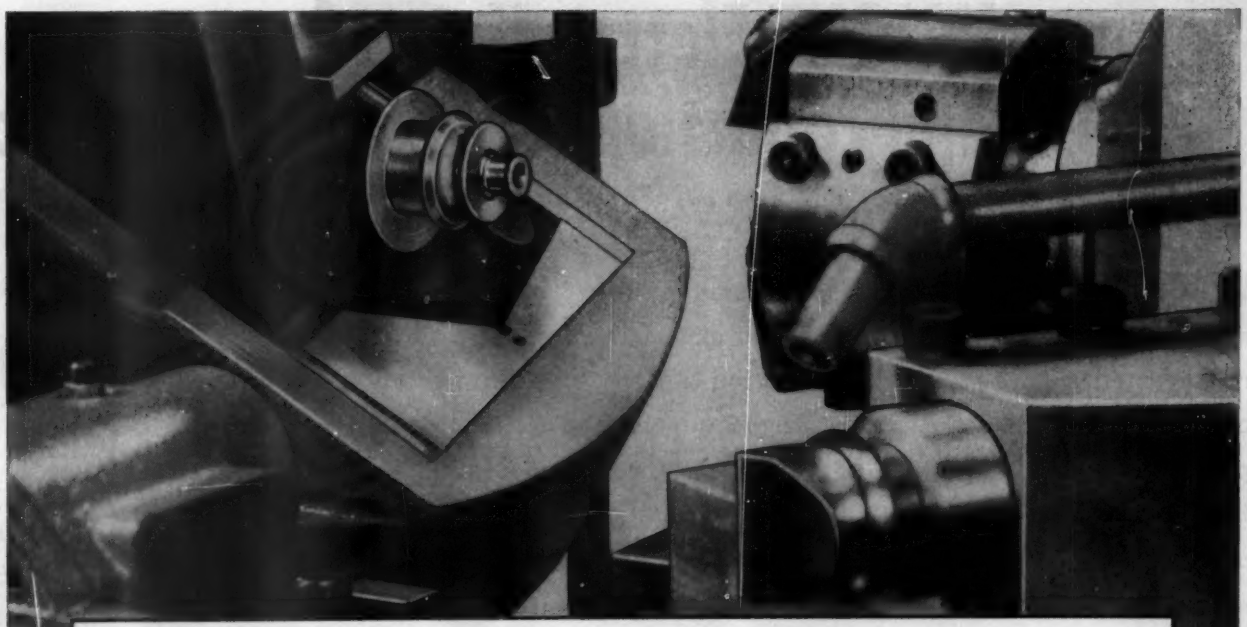
STRENGTH — built into each individual ARMSTRONG TOOL is a safety factor of extra *strength* — *strength* beyond any need, the inherent strength of specially selected materials enhanced by proper heat treatment and hardening.

UNIFORM QUALITY — the uniform quality made possible by modern manufacturing methods, in a specially-built plant equipped with every needed quality control. The name ARMSTRONG with the Arm-and-Hammer Trade Mark is universally recognized as a guarantee of finest quality.

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

5215 WEST ARMSTRONG AVE. • CHICAGO 30, ILLINOIS



From PROBLEM to PROFIT

in just 3.59 minutes . . . with a

POTTER & JOHNSTON 6DRE-40

Automatic Chucking Turret Lathe

HERE ARE THE FACTS

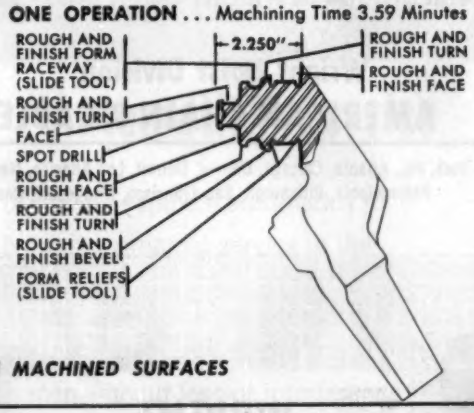
PART: Cutter Bit Arm

MATERIAL: 4812 Steel Forging

REQUIRED: 18 separate, precision cuts . . . including some "fussy" single point form turning.

COMPLETED: Quickly, economically in 1 completely automatic cycle!

ONE OPERATION . . . Machining Time 3.59 Minutes



HEAVY LINES INDICATE MACHINED SURFACES

And remember, this is *not* an exceptional, "done-for-the-record" case history. It's a regular production job that typifies the day-in-day-out performance you can count on because a P&J 6DRE-40 has the advanced design, added rigidity, extra speed and power, and versatility to take tough jobs in stride. And when you team this P&J Automatic with tooling engineered by P&J Specialists, you really have a cost cutting, profit building combination.

SEND NOW FOR COMPLETE INFORMATION

Write today for your free copy of Bulletin No. 159 describing the P&J 6DRE-40 in detail. Complete engineering data is included.

Precision Production Tooling for more than Fifty Years

POTTER & JOHNSTON COMPANY

PAWTUCKET, RHODE ISLAND

SUBSIDIARY OF PRATT & WHITNEY COMPANY, INCORPORATED

MODERNIZE WITH POTTER & JOHNSTON . . . REPLACE FOR PROFIT

ACCO products

WRIGHT Electric Hoists for Top Production, Easiest Maintenance

WRIGHT *Speedway* Electric Hoists—Frame 1, Frame 2 and Frame 3—are ideal **HOISTS** for handling production materials where the load requirements **ARE** from ¼ ton to 10 ton capacity. Their design includes many advanced **SAFE** operating features. Sound choice of components provides them with **EFFICIENT** balance for smooth running. Parts are designed and built to give **RUGGED** performance with a minimum of care. Plant operating men find them **ADAPTABLE** to almost every type of shop work because of the wide range of speeds, lifts and mountings.

The more particular you are in your selection of hoisting equipment—the more likely you are to choose WRIGHT

Write our York, Pa., office for any or all of these fully informative bulletins—

Bulletin DH-133B on Frame 1 and 1½ WRIGHT Speedways
Catalog E-54A on Frame 2 and 3 WRIGHT Speedways
Bulletin DH-504 on WRIGHT Electric Roller Chain Hoist

ACCO

Wright Hoist Division
AMERICAN CHAIN & CABLE

York, Pa., Atlanta, Chicago, Denver, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

for Better Value

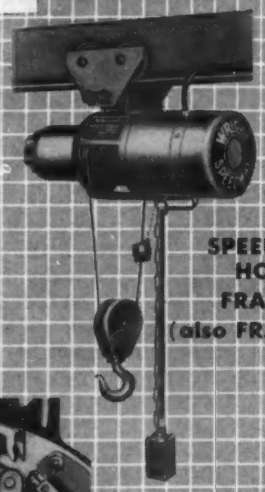
SPEEDWAY HOIST FRAME 2 FRAME 3

MOTOR BRAKE & SOLENOID FRAME 2 and FRAME 3 HOIST
"Nothing to adjust but the cam!"

WRIGHT
Electric Roller Chain Hoist

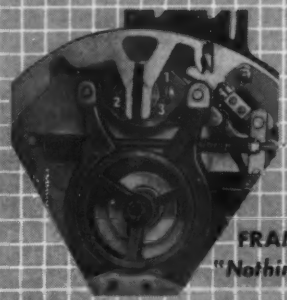
- ¼, ½, 1 and 2-ton capacities
- Fewest number of wearing parts
- Self-locking, double-worm gear acts as own load brake
- Spring-set, shoe-type motor brake, clam shell type
- Oversize precision ball bearings
- Forged steel-alloy hook, swings and swivels

COMPETITIVELY PRICED



SPEEDWAY HOIST FRAME 1 (also FRAME 1½)

THIS DOUBLE-WORM GEAR ELIMINATES TROUBLESOME LOAD BRAKES



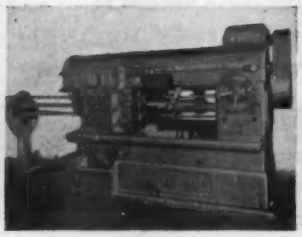
MOTOR BRAKE FRAME 1 and FRAME 1½
"Nothing to adjust but the cam!"

First with NEW "Automatic" Service

Cone was the first builder of multiple spindle automatics to provide machine users with an experimental service in the application of carbide tools.

This service is a practical means of determining the possibilities of carbide tools for production men without loss or interference with their regular production schedules.

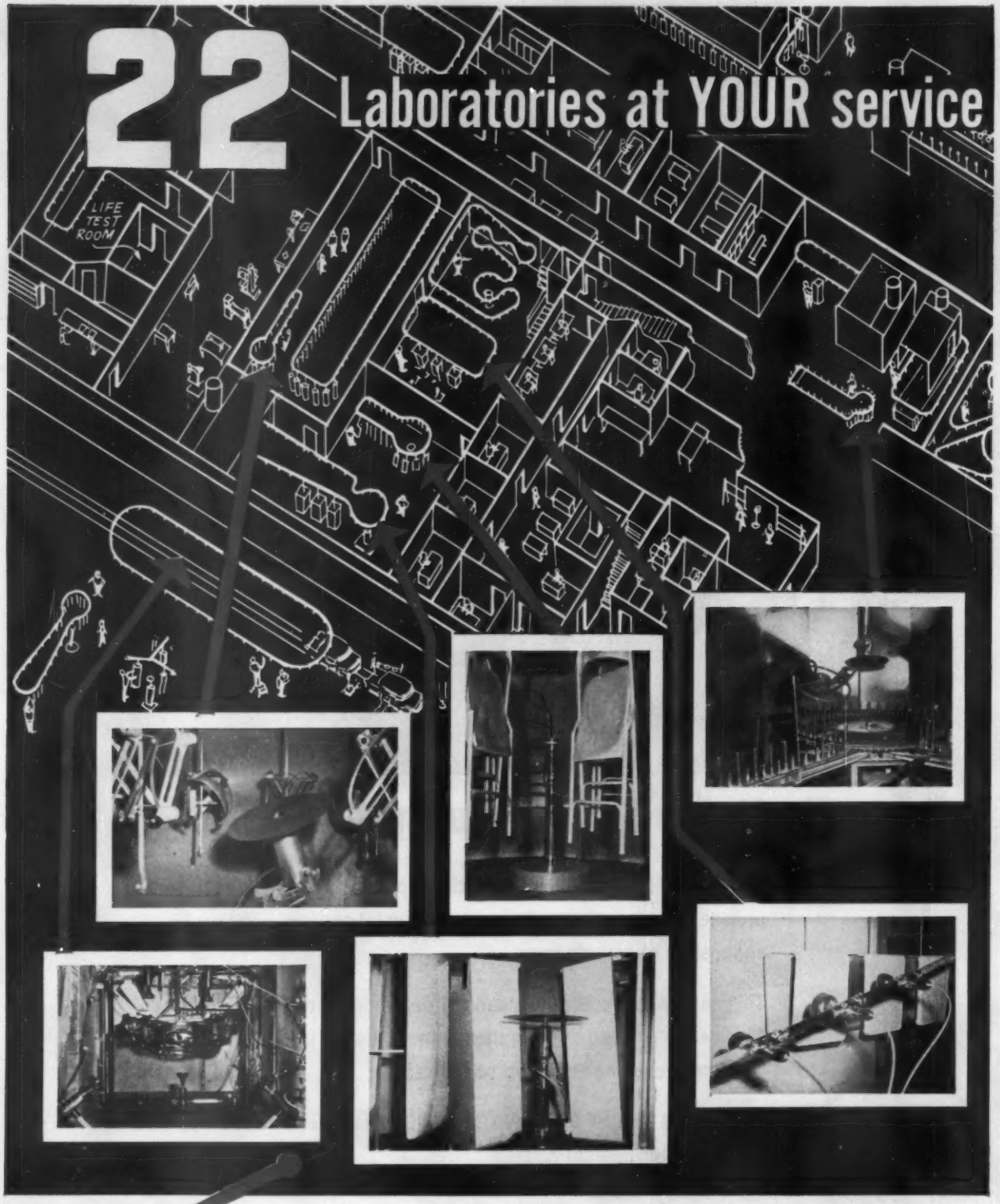
A pamphlet "FOUR STEPS WITH CONE" describes this service. Send for your free copy.



Conomatic

CONE AUTOMATIC MACHINE COMPANY, INC., WINDSOR, VT., U.S.A.

22 Laboratories at YOUR service



YOUR JOB, LIKE THESE SHOWN ABOVE, WILL BE TEST PROVEN

under simulated production conditions to determine cost-saving benefits and other advantages. Ransburg also maintains other test facilities in Los Angeles, London, England; Bad Hersfeld, Germany; Paris, France and Sydney, Australia.

to prove the painting of YOUR products with

RANSBURG

Electrostatic Painting Processes

Let us make laboratory tests and prove the advantages and cost-saving benefits of painting YOUR products AUTOMATICALLY with one of the Ransburg Electro-Spray Processes.

GET THE FACTS . . . IT COSTS YOU NOTHING!

STEP BY STEP—HERE'S WHAT YOU GET . . .

- Survey of your plant by Ransburg's experienced field engineers, including savings estimate.
- Lab painting demonstration of your products, using equipment closely simulating your own production conditions.
- Accurate measurements of paint film thickness.
- Engineering report of detailed tests to determine paint and labor savings.
- Coated samples of your job, lab production photos, and even movies if desired.
- Detailed drawings of equipment and workholder.

All of the above without obligation to you. And, before equipment is installed you receive detailed, pre-installation instructions. Too, a well-qualified, experienced engineer supervises installation and trains your operator on the job. Ransburg offers continuing laboratory and field service to help you with any of your finishing operations.

Ransburg

ELECTRO-COATING CORP.
Indianapolis 7, Indiana

● **First,** Ransburg sales engineers will make a survey in your plant to check the possibilities of using Electrostatic Spray Painting on your products. Next, you will send samples of your unpainted products—with paint—to the Ransburg laboratories in Indianapolis.

Here, the technical staff takes over. The Ransburg Engineering staff—which includes PH.D's and Masters in Physics, Science, Electrical, Mechanical and Chemical Engineering—makes a complete study of your job. Not only do they have the necessary academic training, but they have the "know how" gained from years of actual experience in the field. Ransburg, you know, was the pioneer in Electrostatic Spray Painting 15 years ago. Engineers and well-qualified technicians have at their disposal every facility for conducting complete tests, simulating your own production conditions. They'll decide which type conveyor is best suited for your job. (There's a conveyorized lab set-up—22 in all—to handle products ranging in size from automobile bodies and chassis to small components, such as window hardware.) They'll design workholders, if necessary, and determine exactly how your job can be run to your best advantage. Details, such as fixture spacing, will be worked out too.

After preliminary studies and tests, you are invited to Indianapolis to see your job run in the lab. If you wish, photos and even movies of your test run can be made and furnished for your own production people to study. You see first-hand what Ransburg Electrostatic Spray Painting can do for you in your own plant.

YOU GET PAINT AND LABOR SAVINGS

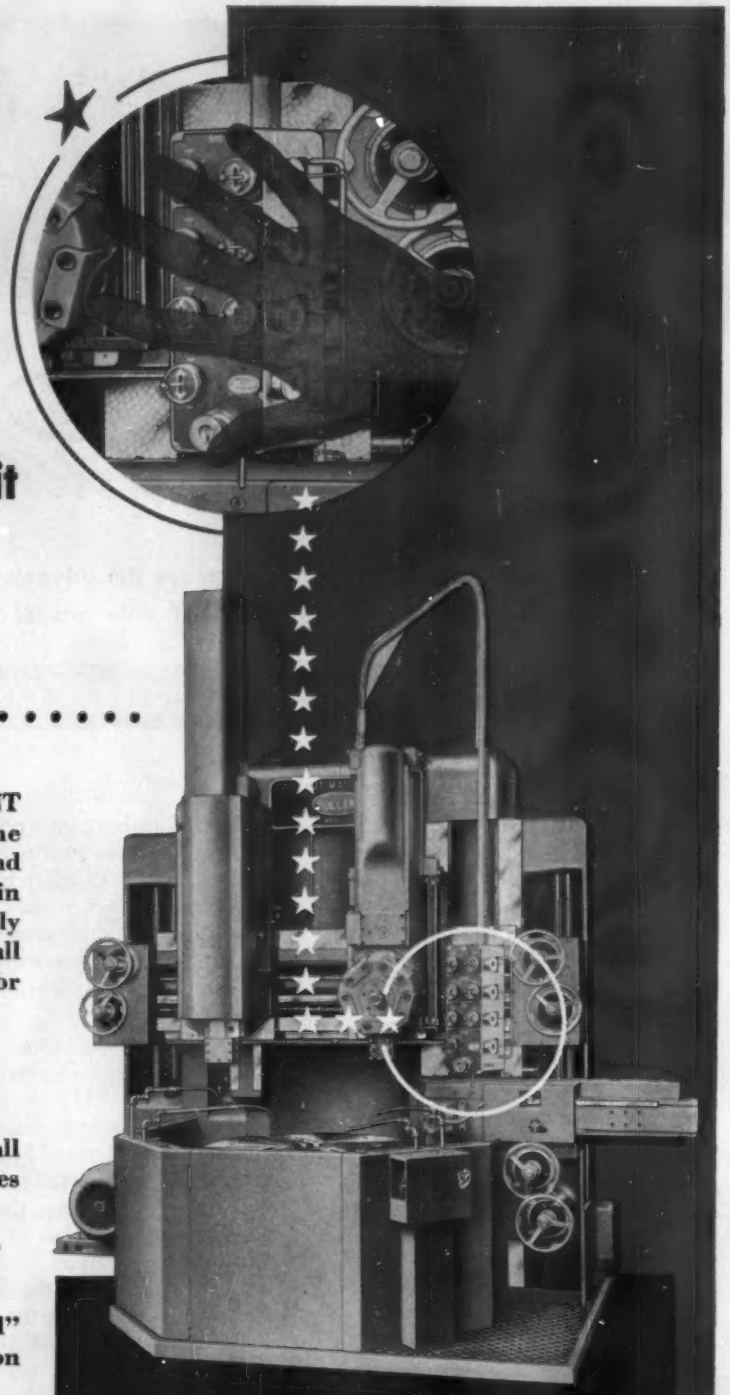
Paint usage is accurately measured during the demonstration. The Ransburg No. 2 Process will provide savings up to five times the paint mileage of hand spray. And, one unit can do the work of many hand sprayers. You will see the improved, uniform quality of the work . . . you'll know what kind of increased production to expect, and you can recognize labor savings. ALL OF THIS WITHOUT OBLIGATION.

Ransburg service doesn't end there. After the equipment is installed in your plant—with our supervisory help—we will train your operator and continue to work with your finishing department. Our technically-trained field service engineers are always available to assist with any of your finishing problems.

Briefly, that's our story. Now it's your move. Call or write. Dept. AM

Within the Span of a Man's Hand

The power to transmit the commands of the operator *to the machine* . . . . . .



By means of the movable PENDANT CONTROL the start and stop of the spindle; selection of speeds, feeds and directional movements of all heads in feed or traverse are quickly and easily accomplished. Interlocks and a stopall stick provide safety for both operator and machine.

Additional features include:

SCREW FEED

for vertical and horizontal motion of all heads — to assure fine smooth finishes with greater accuracy.

POWER INDEXED MAIN TURRET (optional)

Five sided turret for "run of the mill" jobs. Four sided turret for production jobs.

SEVENTY FIFTH ANNIVERSARY
1880 BULLARD 1955

CUTMASTER VERTICAL TURRET LATHE Model 75

AVAILABLE IN 26, 36, 46, 56, 66 AND 76 INCH SIZES

THE BULLARD COMPANY

BRIDGEPORT 2, CONN.

Making good—fast!

NEW the Norton R51 Centerless Feed Wheel

Not just the "other" wheel on your centerless grinding setup — not just another feed wheel! But a Norton "Touch of Gold" development that proves the importance of the feed wheel to economical centerless grinding.

Users report latest Norton development a top-performing aid to better, lower cost centerless grinding

Shopmen who have tried the new Norton R51 centerless feed wheel have come out strong for this latest Norton aid to more efficient centerless grinding. Here are some typical R51 performance reports:

"They hold form twice as long as previous wheels."

"No slipping, lighter cut with diamond required when truing."

"An excellent wheel; no chipping, holds a much better corner and dresses easier."

"Eliminates chatter and gives us better all around grinding results."

The secret of this greatly improved performance is in the exclusive Norton manufacturing methods. The unique abrasive-and-bond combination lengthens wheel life, increases form-holding ability, reduces the need for dressing and eliminates slippage. And as a result of close control during manufacture, R51 wheels are consistent throughout — from wheel to wheel and lot to lot.

Finally, you get time-and-money-saving simplification with R51's. Just one grain and grade will handle the widest range of jobs.

Heighten the "Touch of Gold" in your centerless operations by teaming up the new R51 feed wheel with the right Norton grinding wheel. And remember: only Norton offers you such long experience in both grinding wheels and machines to help you produce more at lower cost.

R51 wheels are available in all common feed wheel sizes. For complete facts write to NORTON COMPANY, 91 New Bond Street, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone directory, yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Massachusetts.

W-1681

NORTON
ABRASIVES

Making better products... to make your products better

NORTON COMPANY: Abrasives • Grinding Wheels
Grinding Machines • Refractories

BEHR-MANNING DIVISION: Coated Abrasives
Sharpening Stones • Pressure-Sensitive Tapes

BAY STATE MOUNTED WHEELS & POINTS

These "WHEELS of PROGRESS" are establishing outstanding records of achievement and dependability.

They are uniform in density and hardness.

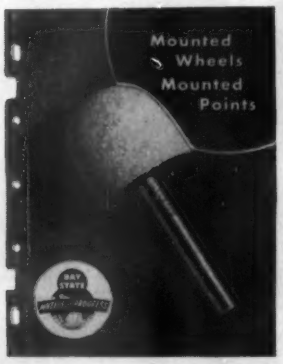
All shaped points are trued to exact size and shape *after* mounting on spindle, positive test of ability to hold to spindle . . . run-outs can't occur . . . ready for action, dressing before using not required.

Deep knurling for extra safety, in high strength alloy steel spindles and special adhesive . . . the abrasive heads stay on spindles.

Longer useful life . . . can be used right down to the spindle.

A wide range of shapes and specifications available for immediate shipment from distributor and/or warehouse stocks.

Call on your local BAY STATE DISTRIBUTOR, he's a key man on all grinding problems.



This New Mounted Point Handbook is packed with information about BAY STATE Mounted Wheels and Points, including bonds, lubricant treatments, etc. Send for your copy today.

BAY STATE ®
WHEELS of PROGRESS

BAY STATE ABRASIVE PRODUCTS CO.,
Westboro, Mass., U.S.A.

Branch Offices and Warehouses — Bristol, Conn.; Chicago, Ill.; Cleveland, Ohio; Detroit, Mich.; Pittsburgh, Pa.
Distributors — All principal cities
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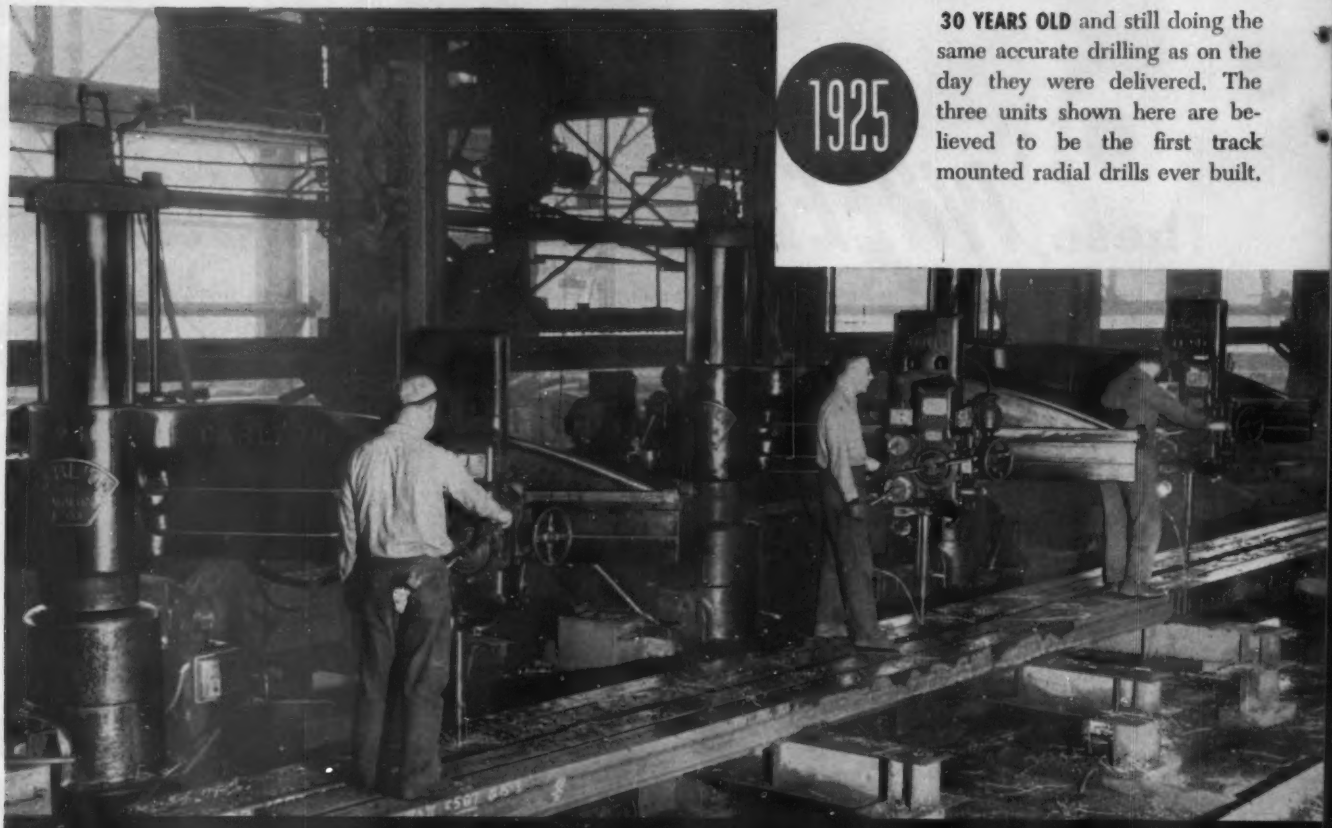
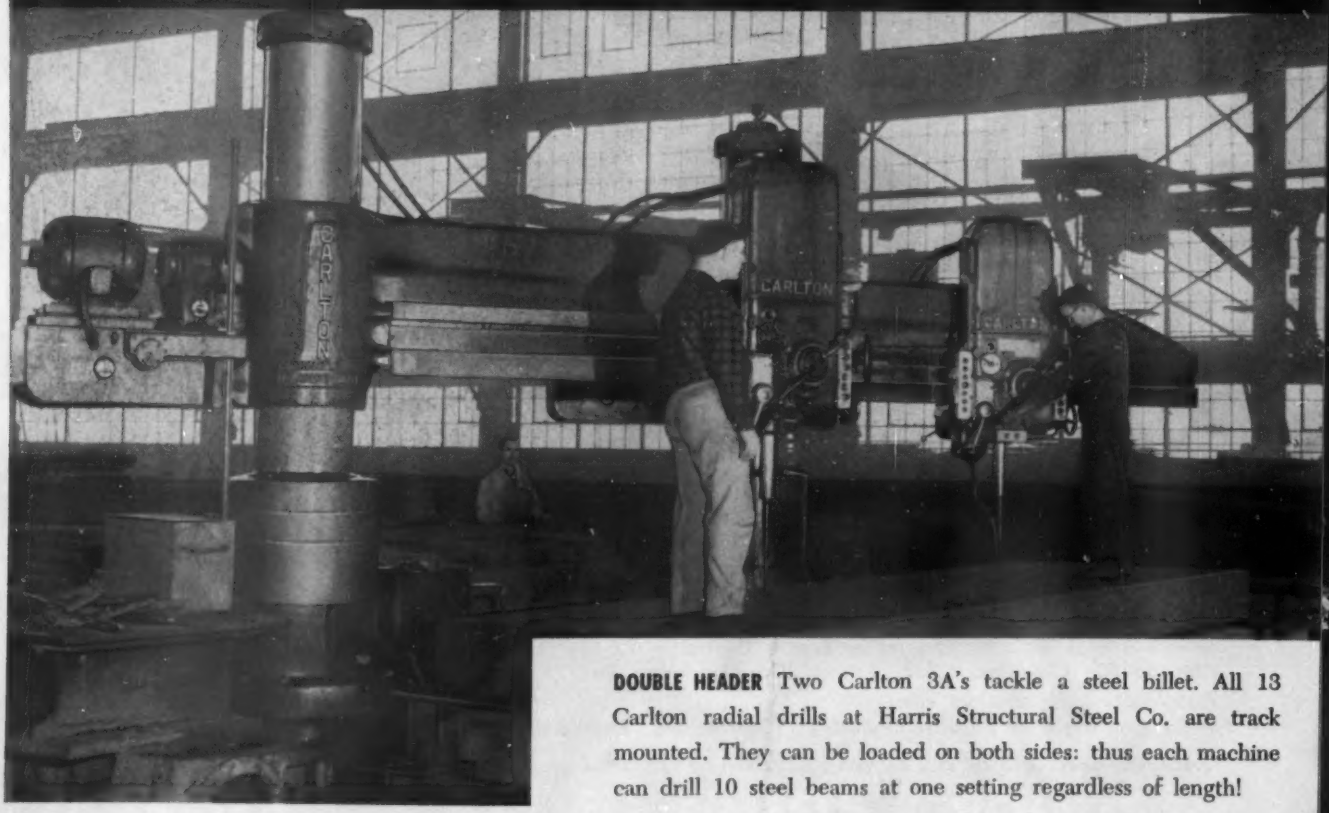
Manufacturers of all types of Quality Abrasive Products



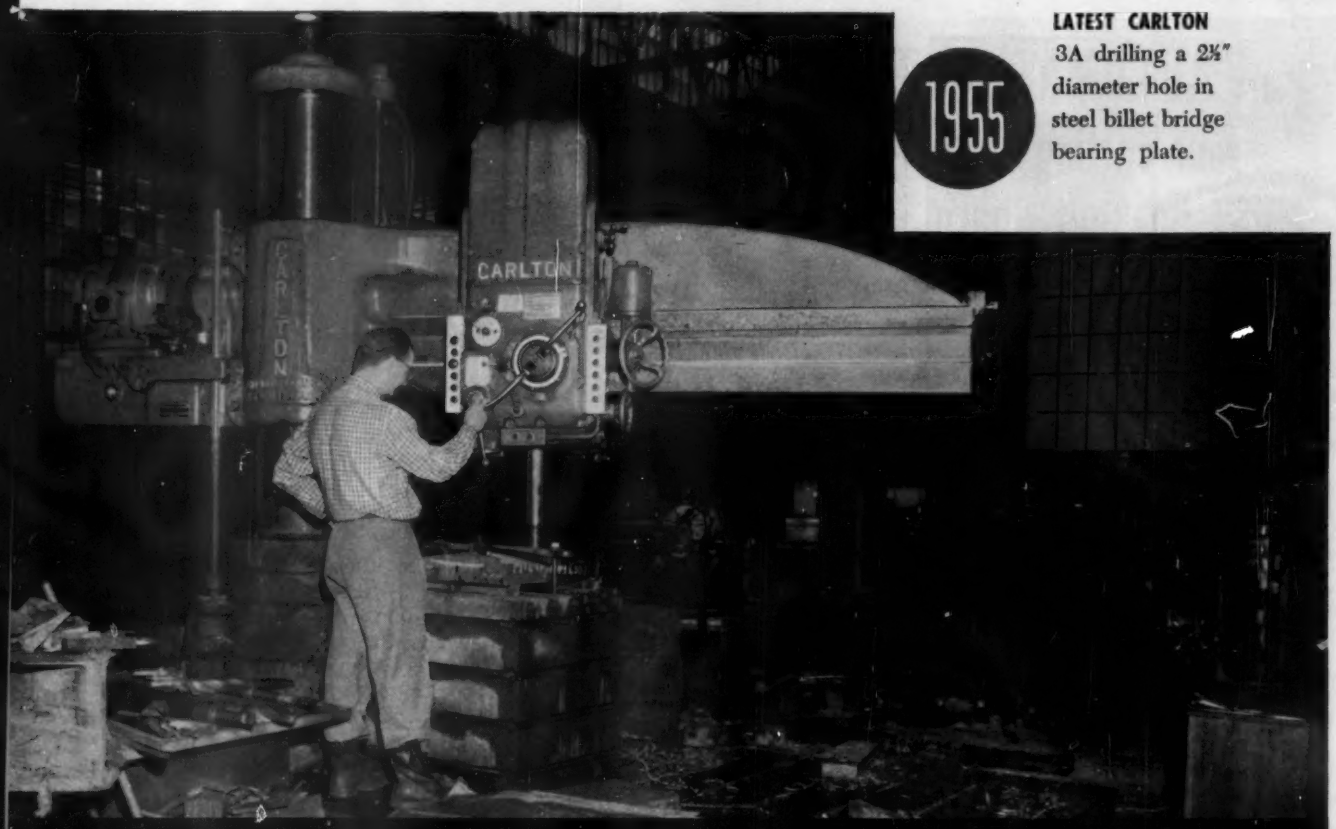
1925

30 YEARS OLD and still doing the same accurate drilling as on the day they were delivered. The three units shown here are believed to be the first track mounted radial drills ever built.

"Practically no downtime on



DOUBLE HEADER Two Carlton 3A's tackle a steel billet. All 13 Carlton radial drills at Harris Structural Steel Co. are track mounted. They can be loaded on both sides: thus each machine can drill 10 steel beams at one setting regardless of length!



1955

LATEST CARLTON
3A drilling a 2½" diameter hole in steel billet bridge bearing plate.

Carlton Radial Drills in 30 years"

...W. Harris, Mgr., Harris Structural Steel Co.

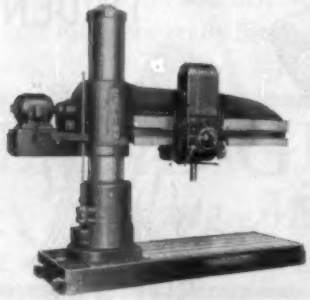
"It costs practically nothing to keep a Carlton operating in good condition—less than $10 a year. And we ought to know, because we have bought 13 Carlton radial drills during the last 30 years."

This is from an unsolicited statement by Mr. W. Harris, Manager, Harris Structural Steel Co., New York, who also states that "downtime of the Carlton machines has been practically nil."

"We now have 13 Carltons in our New Market, N. J. shop," Mr. Harris continues. "These have been purchased at regular intervals since 1926, and each new machine shows significant design and operating refinements. This indicates to us that Carlton engineering and manufacturing is alert and progressive, that Carlton radial drills are constantly being improved and are therefore always up to date."

* * * *

Thank you, Mr. Harris. There's nothing we can add to that except to say that Carlton radial drills are made in arm lengths from 3-ft. to 12-ft. and column diameters from 9" to 26". Carlton also manufactures horizontal drills in 4H and 5H sizes. For complete information on the size and type best suited to your drilling requirements, send today for descriptive literature. The Carlton Machine Tool Co., Cincinnati 25, Ohio.



Carlton
horizontal and radial drills

Get "the hole story"... send today for descriptive bulletins.

for AUTOMATION
...your cutting tools MUST be kept Sharp and Accurate
—equip with an OLIVER "Automatic" Face Mill Grinder

Automation CAN bog down if your cutters are not kept sharp and accurate. The thrifty Oliver is simple to operate (one man can easily run several machines at a time) . . . yet it grinds a greater number of accurately-ground milling cutters per hour than ordinary face mill grinders.

The efficient Oliver automatically indexes and machine grinds each tooth in succession until the entire cutter is completely and accurately ground. The shape of the tooth is determined by inexpensive, easily replaceable, hardened cams.

The lasting accuracy of the OLIVER "AUTOMATIC" FACE MILL GRINDER is assured . . . at each stroke the wheel passes over a fixed diamond compensating for wheel wear. This unique Oliver feature enables tungsten-carbide and high speed inserts to be easily and rapidly ground to any degree of accuracy and quality of finish.

We'll be glad to tell you more—just write, wire or phone.

OLIVER INSTRUMENT CO.
1414 E. MAUMEE · ADRIAN, MICHIGAN

Backlash

EXTRACTS FROM CURRENT LETTERS TO THE EDITORS

Mebbe So

Mr Colvin may be correct in saying that only the axles, frames, and bodies of the Pierce-Arrow cars shipped to England were made of aluminum (*AM*—Nov 21 '55, p98). But the company did make some engine blocks of aluminum. Whether they were ever actually used, I do not know, but I do well recall seeing them on the floor of the shop and being amazed at being able to pick them up with one hand. The ones I saw were in the rough, so I don't know whether they were to have steel liners. Anyhow, the foreman told me that they had built an all-aluminum engine and that it had run OK. He also mentioned that during a test run on one of the aluminum cars the driver had run into a tree and bent the front axle. When they straightened it they found it took more tonnage than straightening a standard steel axle.

Rob't Beardsley
Buffalo, NY

No More DP's

The idea of the mobility of labor (*AM*—Nov 7 '55, p111) is all very well in theory, but in practice it does not work out so well. It completely ignores the human factor. Take the case of a man who has worked ten years at a certain plant in a certain town. His children are doing nicely in the local schools, his wife is active in civic affairs, he belongs to a local bowling club. They are a settled family, have old friends on whom they can call in an emergency, and are known and respected in the community.

Can you expect this man suddenly to become mobile, to tear up his roots and move to a new town where he is a stranger? Sure, the new job will pay more money, but money is not the sole criterion. At his age it is not so easy to make new friends, his wife will be unhappy without the weekly bridge game with the girls she went to school with, and his children may well lose a whole term, even a whole year, because of the different school standards.

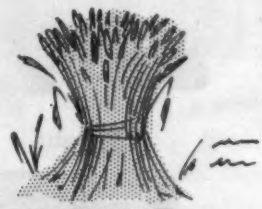
Mobility was enforced in England during the war, but only for the

GRINETICS

By D G SMITH

ANNULAR RING

TRIDENT



SHEAVE

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At Ford Instrument Co., the answer is *Leland-Gifford* Drilling Machines

Problems involving precision mechanisms are duck soup for Ford Instrument Company, Division of Sperry Rand Corporation. They have the talent and the equipment to produce the right answers in the simplest and most practicable form.

Among their equipment is this battery of Leland-Gifford multiple spindle drilling machines. Here precision drilling operations are handled with efficiency and dispatch.

The right tools are ready for use in the right sequence and combination for drilling, reaming, tapping, countersinking, counterboring or spot facing. Work moves smoothly from one spindle to the next, requires a minimum of handling even for the most complex pattern of holes.

Leland-Gifford multiple spindle drilling machines are available in a complete family of sizes and in a wide range of swings, number of spindles and types of feed. New bulletins give complete information. Write for them.

LELAND-GIFFORD
Drilling Machines
WORCESTER 1, MASSACHUSETTS, U.S.A.

CHICAGO 45
2515 West Peterson Ave.
DETROIT
10429 West McNichols Rd.
CLEVELAND 22
P.O. Box 853
NEW YORK OFFICE
75 South Orange Ave.
South Orange, N. J.
LOS ANGELES OFFICE
2620 Leonis Blvd.
Vernon 58, Cal.
INDIANAPOLIS 6, P. O. Box 1051
ROCHESTER 12, P. O. Box 24, Charlotte Station

3-Dimensional panto-miller

For accurate pantograph milling on all 3-dimensional work, the "Panto-Miller" 3A is a sturdy production machine. Accurately reproduces copy on flat or curved surfaces, in reduced or magnified size.

NEW:

Capacity for workpiece height.
Sensitivity of linkage.
Range of pantograph ratios.
Accuracy of reproduction.
Finger-Tip Control of spindle speeds.
Ease of operation.

The new Panto-Miller 3A is an economical answer to many standard and special production problems. Write for Bulletin PM3, which gives details and specifications.

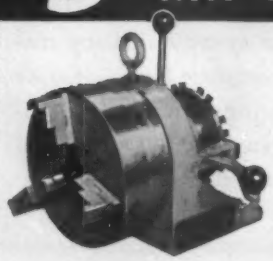
2-Dimensional panto-miller

Versatile and dependable for continuous service, the J & B "Panto-Miller" 2A:

Engraves
Profiles
Die Cuts
Mills

Investigate its advantages for your own applications. Send for Bulletin PM2

3-WAY Indexing Trunnion



Simple, Rapid, Positive positioning of workpiece or jig for all angle Drilling, Tapping, or Counterboring. Available with Chuck, Faceplate, or Right-Angle Adaptor Plate. Complete with Station Selector. For details, ask for Bulletin IT3.

J&B EST. 1870

JOHNSON & BASSETT, INC.

PRODUCTION TOOL DIVISION

WORCESTER, MASSACHUSETTS

unmarried, but as soon as the emergency was over most mobile workers went back home as fast as possible, even though it sometimes meant a lower wage. There's the key word, Home. Neither industry nor government has the right to make DP's of American citizens.

Lawrence Tremain
Chicago

It's Good, But...

A few days ago I visited the Ford Museum at Dearborn where they have a collection of old machine tools, including one of the earliest Maudsley thread-cutting lathes that is nearly the same as the one in the Science Museum, South Kensington, London. It is a rather large and important collection, but it lacks some tools (eg; no Lincoln miller) to make it an altogether representative collection, and has an excess of some specialized items. Thus it could, and I think should, be improved.

In addition, there is a lack of labels on items generally; that is, they are not in sufficient detail. Also, some items are quite wrongly labeled. These points of criticism certainly disparage what otherwise would be a very fine museum, comparable with the best I've seen elsewhere, here or in Europe. And they are not at all offset by loud jazz music bellowing forth from numerous loudspeakers all over the place.

It is of no general importance, but I was interested in seeing there, wrongly labeled, a 5 x 7 "Model" printing press manufactured by my Dad in Philadelphia at the turn of the century. My first job in a machine shop was in the Suverkrop & Coats shop at 628 Cherry St, in 1901 (Yes, I was just 6 years old) running the little power hacksaw, cutting off ⅜ x 3½-in. toggle pins for those presses—at 50¢ per day, which I was sure was one hell of a pile of dough!

Lew Suverkrop
Bakersfield, Calif.

Job Opportunity

The excessive length of time now required to obtain a patent—up to 3½ years—results from the enormous increase in applications during the past few years. Only by getting these applications cleared can new products and processes be put on the market. The key figure, therefore,

in the advancement of American technology is the patent examiner.

Over 100 new examiners have been added to the Patent Office staff during the latter half of this year, but there are immediate openings for some 200 more. Graduate engineers and scientists, and chemistry or physics majors are eligible for appointments without examination upon application to the Commissioner of Patents, Washington 25, DC. Salaries start at $4345 a year with increases to a possible $7570 in five and a half years. Included are liberal vacations, sick leave, and pension benefits.

Henry E Sharpe
N Y Patent Law Ass'n

Nein, Nein

Your edition of THE AMERICAN MACHINIST for June 6, 1955 contains a false information about the German aircraft industry, of which we only got notice but we are not in possession of that edition.

The information is said to be that, "thousands of aircraft industries in Germany are ready to start production and will appear on the world market with the most fashionable machines within a short time."

We should like to ask you from whom you got this wrong information.

Kastner
Bundesverband der Deutschen Luftfahrtindustrie

The wrong information appears to be on the other side. What we really said was, "Some 200 German firms are going into aircraft parts output this month. And now that the lid is off on German airframe building, you can look for brand-new modern-design German planes by the end of 1956."

We were evidently on the beam because word now comes (AM—Nov 21 '55, p105) *that Focke-Wulf already has a light 4-seater private plane in production, the BL502, with a 140-hp engine, a top speed of 135 mph, and a range of 635 miles. We are also informed that Flugzeugbau Nord is to start building the Noratlas; Focke-Wulf will undertake the P149; Ernst Heinkel and Messerschmitt will produce the Fouga Magister; and a group headed by Dornier Werke will build the Do. 27.* —Ed.

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When your production machining problem dictates the use of special carbide tooling, your nearby Gorham Field Engineer can give you the right answers fast! He's an expert in the design and application of special cutting tools . . . and he provides a complete engineering service to determine your exact requirements.

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Yes, your nearby Gorham Field Engineer is a helpful man to have around! If you haven't yet met him, write for his name, or send details of your problem direct, and we'll have him get in touch with you promptly.

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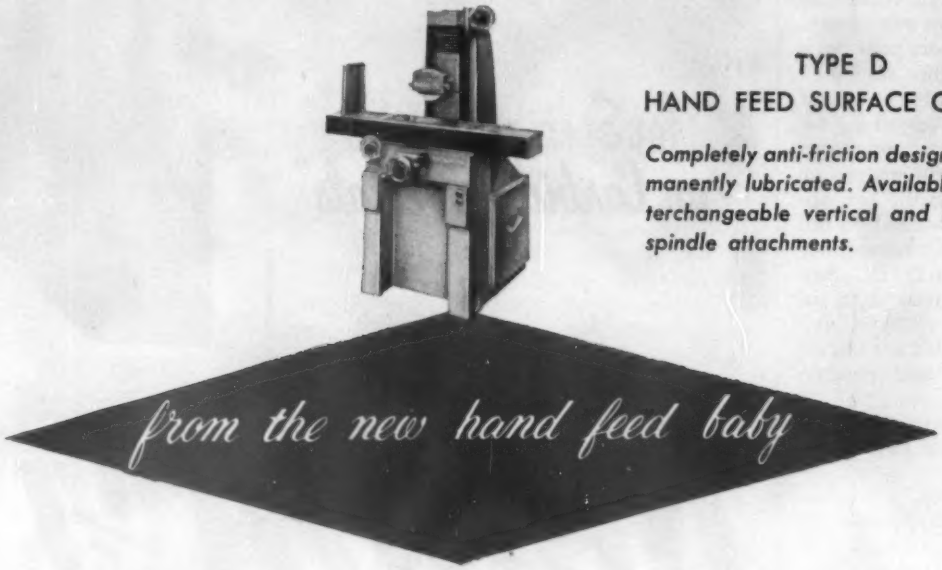
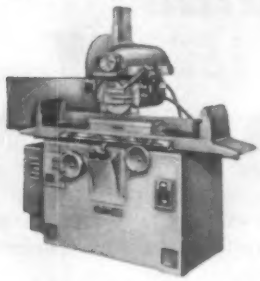


TYPE D
HAND FEED SURFACE GRINDER

Completely anti-friction design and permanently lubricated. Available with interchangeable vertical and horizontal spindle attachments.

TYPE 2F
HYDRAULIC SURFACE GRINDER



Tool room and production grinder with new coolant application both through the wheel and externally.

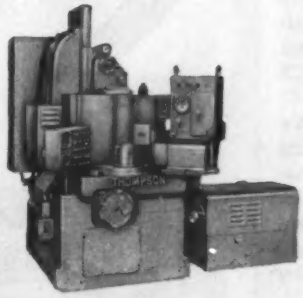
Thompson

PRECISION PETE SAYS:

"Everybody knows Thompson Grinders are the very highest quality . . . but in addition you'll find that they cost no more than many other grinders . . . Buy Thompson for quality and price!"

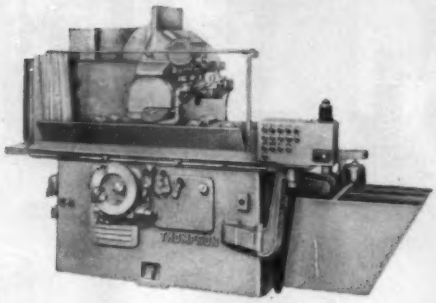
6" TWIN ROTARY GRINDER . . .

with automatic control and automatic gauging.



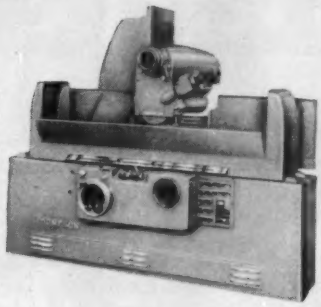
MODEL B TRUFORM GRINDER . . .

the latest 12" x 20" contour grinding machine with automatic crushing and truing cycle.



TYPE G
HYDRAULIC SURFACE GRINDER . . .

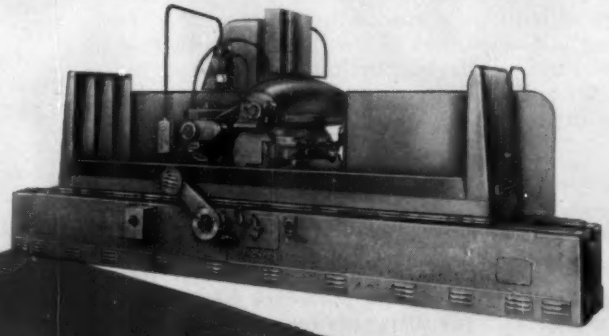
a deluxe surface grinder in 12" x 16" x 36" size range.



. . . invites you to see the newest developments in Surface Grinders.

TYPE CX
DOUBLE HEAD WAY GRINDER

way grinder, 36" x 36" x 120", with both horizontal and vertical heads.



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KING

greater horsepower — expanded speed and feed ranges — permit use of modern cutting tools to their fullest capabilities.

Completely re-designed King® Vertical Boring & Turning Machines bring to boring mill users the greatest productive capacity ever achieved for vertical boring and turning work.

Horsepower has been increased to 40 to 50 H. P. on 30" to 46" machine sizes, 75 to 100 H. P. on sizes 58" and up. Spindle drive provides 24 speeds in each of high, intermediate, and low ranges. As shown in illustration at lower right, the complete drive transmission is mounted in an extra-rugged housing, providing greatly increased stability. The entire drive can be removed from the machine as a unit.

24 feeds from .0016" to .250" per revolution are provided. The exact feed can be selected to produce the desired surface finish on any material at the required production rate.

Complete electrical controls are provided, located on pendant station and on fixed panel mounted on side head, for maximum ease and speed of manipulation.

With many other features, the *all new* King provides industry with a high-efficiency machine tool capable of taking full advantage of new cutting tools, new materials, new methods. For full details, send for new Catalog K-5. Write direct or to the King distributor in your area.

Additional Features of the ALL NEW KING

- NEW SPINDLE AND SPINDLE MOUNTINGS, PROVIDING MAXIMUM TABLE STABILITY.
- AUTOMATIC LUBRICATION OF ALL MOVING PARTS.
- ANTI-BACKLASH NUTS FOR ALL CROSS-FEED MOVEMENTS.
- MACHINE ADAPTED FOR SIMPLE OPTIONAL ADDITION OF:

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WIDE VARIETY OF HEAD COMBINATIONS AVAILABLE

Complete Electrical Controls

All electrical controls are conveniently located on the pendant station and on a fixed panel mounted on the side head. The following controls are located on the pendant, in areas indicated:

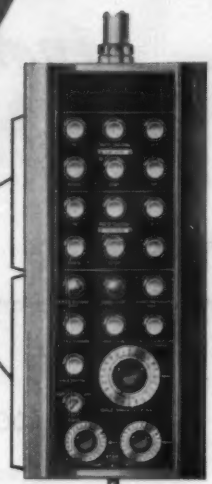
FEED AND RAPID TRAVERSE MOVEMENTS for Rail heads on machines with 2 heads on rail. Rail head and side head on machines with one head on rail.

POWER SWIVELING OF RAIL HEADS

PRE-SELECTIVE SPEED SELECTION FROM DIRECT-READING DIAL

SELECTION OF RAIL HEAD FEEDS FROM DIRECT-READING DIALS

SPEED CHANGE • TURRET INDEX • TABLE STOP



FIXED PANEL on side head has controls for:

FEED SELECTION FROM DIRECT-READING DIAL

FEED AND RAPID TRAVERSE MOVEMENTS OF SIDE HEAD (on machines with two heads on rail)

MAIN DRIVE • RAIL POSITIONING • COOLANT PUMP

THREAD CUTTING & TAPER TURNING SELECTION FOR ALL HEADS

Spindle Drive Transmission

Re-designed throughout.

EXTRA-RUGGED HOUSING provides increased stability and rigidity for mounting of shafts.

Short shafts used throughout with points of load located adjacent to bearing supports.

Spot News of Metalworking . . .

- **Air Force is easing off on its no-new-defense-plants-on-either-coast policy.** AF Secretary Quarles told West Coast airframe builders that they're indispensable and that if it comes to a choice between industrial dispersal and cutting the flow of weapons, the latter will win out every time.

- **Ford is having a tough time getting men for its new Cleveland stamping plant.** Its site at Walton Hills, 14 miles SE of Cleveland, is too far from available industrial manpower, and Chrysler intends to put its stamping plant closer to the workforce center. Thus Ford has had to scour the hills of Pennsylvania and West Virginia for employees.

Increasing scrap prices could easily be the trigger for a general steel price increase. Recently, 22,000 tons of production scrap bundles brought $53 a ton. That's $5.50 a ton higher than it was just six weeks ago. One of the reasons for the price rise is the anticipated reentry of some big steel producers into the market—but the catch is that higher prices aren't bringing out more scrap.

- **First production tape-controlled machine tool in England** is a special copy miller, made by Research Engineers, Ltd, for Laurence, Scott & Electromotors Ltd, Norwich. It uses the EMI system, applicable to a variety of types. Key dimensions in polar coordinates are copied on a teletypewriter which produces a perforated control tape and a typed checking copy. Tape runs through the control head at machine cutting speed, so only key points near the tool need be "remembered." An interpolator deduces, from a small number of points, the general form of curve and varies table-rotation speed to maintain optimum cutting speed.

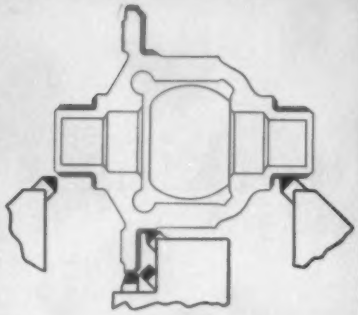
- **You can buy sheet metalworking machinery on long-term installments now.** A major manufacturer of hole punching and notching equipment will give you anywhere from 3 to 10 years to pay, after a small down payment.

Decision on this Buffalo lawsuit should be of interest to all industry: Buffalo Metal Container Corp is suing (1) its ex-chief engineer individually for $250,000, and (2) the chief engineer and six other former employees collectively for the same amount. The charge: they "entered into a conspiracy to deprive the plaintiff of its principal customers, its key employees . . . accounts . . . and good will." A New York ad agency won a similar judgment for $300,000 two years ago.

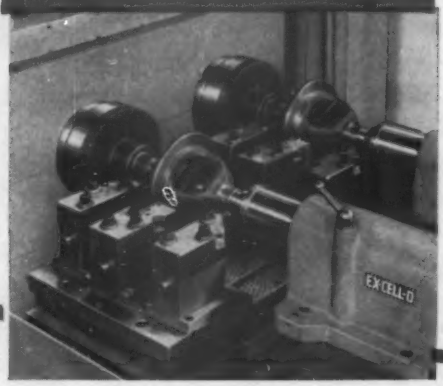
- **Claiming major steel producers are squeezing independent fabricators** out of business, Independent Iron Works, Oakland, Calif, has filed suit for $12 million against 10 steel companies, among them U S Steel, Bethlehem, Kaiser, Jones & Laughlin, Republic, Inland and Armco.

- **Steel pipemaking machine that makes 100 fpm of 3.5 to 12.75 in. dia pipe** per minute for oil and gas lines is being built by Etna Machine Co of Perrysburg, Ohio, for Bechtel Corp's new Edmonton, Alberta, subsidiary.

- **Electroplaters want Congress to investigate a gray market in nickel.** They say operators are taking advantage of the shortage to get four times the normal price, and not only that, nickel allocations are so inequitable that they're causing widespread unemployment.



Heavy lines show the surfaces machined.



Style 112-D Ex-Cell-O Precision Boring Machine with double set-up.

Close-up of the two differential cases, in work position. This precision work is done with hydraulic feeds and easily-controlled automatic cycles.

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Workpieces are automotive differential cases—precision work—limits of plus or minus .005" on diameters.

See how Precision Boring Machines can save time and money for you. Call your local Ex-Cell-O representative, or phone or write Ex-Cell-O for a Precision Boring Catalog.

55-49

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MANUFACTURERS of PRECISION MACHINE TOOLS • GRINDING SPINDLES • CUTTING TOOLS • RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

Washington . . .

Vance Plan dumped . . .

The Vance Plan for stockpiling machine tools and building up reserve arms-making capacity has been officially scrapped (see p146). About $178-million appropriated by Congress for the program in the past two years, and still unobligated, will not be spent.

The $22-million worth of equipment ordered by the Air Force earlier this year will go into current aircraft production when delivery is made, instead of being kept on standby for future use.

Aside from machine tool interests, there was very little effort in Washington to keep the Vance Plan. Even the Office of Defense Mobilization, under whose aegis the tool stockpile scheme was first hatched, exerted little if any pressure on the Pentagon to carry out the program—which under the Eisenhower administration has been a controversial one from the start. Defense Secretary Wilson has never been more than lukewarm in his enthusiasm.

Another factor responsible for the plan's demise: some if not all the former members of ODM's Vance Advisory Committee on Production Equipment have apparently changed their minds on the wisdom of creating standby weapons production capacity.

One of the members of the now-defunct committee told *American Machinist* "Wilson is right in not spending this money. The whole concept of full mobilization has undergone a change in the last three years. Basic thinking on the kind of weapons and the time factor in a future war, especially, have changed."

Presumably, he mirrors the views of other Vance committeemen still close to the mobilization scene.

His reference is to the recent Pentagon policy shift from dependence on an industrial base in a long war to preparedness for a short nuclear war. Under such a concept, Washington officials question the wisdom of spending defense funds for reserve tools and consider the project a marginal one. Such an interpretation, of course, jibes with the official effort to hold down military expenditures.

Plan bogged down . . .

The former Vance Committee member said the Reserve Tool Plan was handled badly on the budget side. During the past three years, the Defense Dept set up a special Reserve Tool Fund in the budget for the office of the Secretary. Congress appropriated money directly to this office, not to the individual services. OSD then allocated the money to the three services after screening the projects.

There was a "great misconception" that the Vance Committee recommended this procedure, this top official now says. He claims the committee opposed the creation of a special appropriation fund in OSD, expected each service to seek reserve tool money along with its regular funds for military items and production equipment.

Says American Machinist's informant: setting up the special fund was foolish—it stuck out in the budget, giving Congress and others a chance to cut it down as a postponable project.

Standby turbine capacity . . .

The future of the ODM-GSA $70-million Machine Tool Procurement Plan for building up standby turbine capacity seems uncertain in light of the administration's decision on Defense Dept reserve tool buying.

You get conflicting views on the outlook. One ODM official thinks the project should not be carried out, says "it sticks out like a sore thumb." Another official close to the situation believes the Pentagon decision won't affect turbine tool procurement. He implies, however, that the new production equipment for turbines might go for current production of propulsion turbines rather than kept on standby, as originally proposed.

GM hearings are over . . .

Don't look for any legislation out of the month-long General Motors hearings held by the Senate's Antitrust and Monopoly Subcommittee . The big fuss came over GM's—and the auto industry's—dealer relations, and wound up with GM President Harlow Curtice announcing a new 5-year contract for its dealers, to replace the present one-year contract.

On the committee's larger interest—the reason for GM's success in so many metal-working fields—Alfred Sloan, GM chairman of the board, shared the committee spotlight with GM President Harlow Curtice.

Sloan said GM never expanded just to expand, that there always had to be a reason for GM's moving into diesel locomotives, buses, earthmoving equipment, household appliances, and the like: there "had to be a real reason for it . . . and it had to strengthen GM's structure."

Sloan said he didn't think there would be any more GM expansion into the parts and accessories manufacturing field, but then quipped: ". . . I'm not making any commitment on this."

Sloan knocked down any idea that GM is inefficient because of its size, that smaller outfits might be more efficient producers. Sloan said size hasn't anything to do with this, that GM could be "twice as big as it is now and still be efficient."

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PRECISION

in millionths of an inch

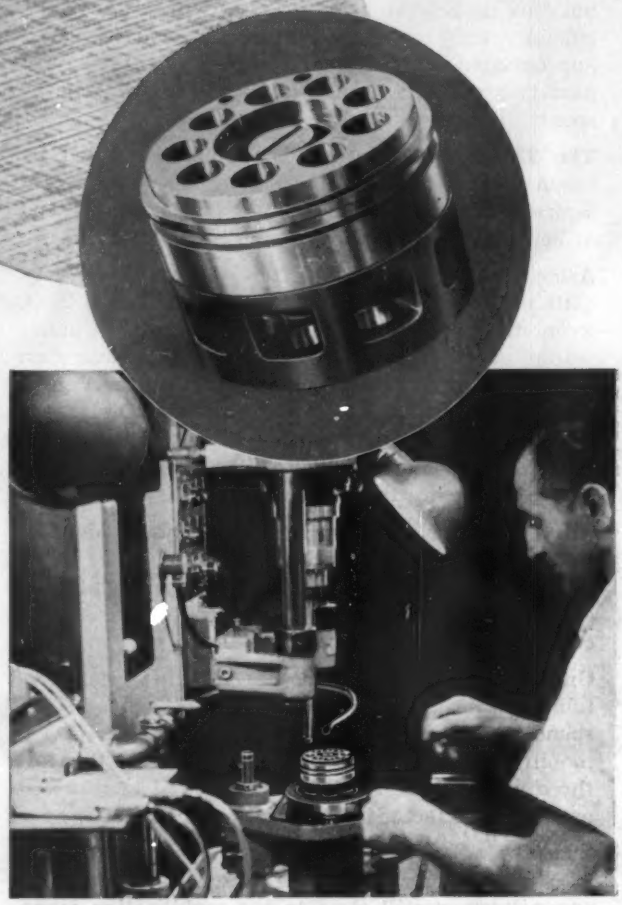
MICROHONING is inherently the most accurate of all production methods used for stock removal. Four major characteristics make Microhoning the controlled abrading process—that produces precision in every part.

Low velocity abrading technique
—low speeds (50-250 SFPM) minimize heat and surface stresses.

Sharp cutting abrasive grits at all times
—the self-dressing action provides clean, constant cutting and uniform surface finish.

Self-alignment of tool with bore
—use of the "float" principle . . . either the tool or workpart has universal action . . . automatically aligns tool and bore to correct bore inaccuracies without changing bore location.

Large area of abrasive in constant contact with work surface
—cutting pressure is evenly distributed over the surface by the thousands of minute abrasive grits collectively removing substantial amounts of stock. There is no localized heat to damage the surface or sub-structure of the metal.



An aircraft hydraulic pump block component, made up of cast iron and hardened steel (58-60 Rockwell "C"); nine ported cylinder bores are Microhoned to obtain surfaces which will maintain a "running" seal and which will not gall or "pick-up." From .006" to .008" stock is removed from each bore while holding these tolerances:

geometry—.000025"
diameter—.000050"

Steel surface finish is held under 8 microinches; cast iron, under 10 microinches. Bores of both sections are Microhoned in line in the same operation.

For a more complete story on this application, write for CROSS-HATCH, Vol. 7 No. 4.

*MICROHONING = Stock Removal + Geometry + Size Control + Surface Finish

MICROMATIC HONE CORPORATION

8100 SCHOOLCRAFT AVENUE • DETROIT 38, MICHIGAN

Detroit . . .

Studebaker-Packard '57 tool-up . . .

Completely restyled Studebaker and Packard bodies for '57 is the word going around Detroit. While tooling expenditures for the two lines are supposedly a well-kept secret, it's auto insiders' guess tooling will run in the neighborhood of $50 million.

Packard "dream car" sketches show some innovations that might well appear in 1957 standard models: headlights in the sketches are hidden behind motor operated flaps; rear windows protected by a roof overhang; aluminum sections over the doors that slide back into the roof so you can get in—an indication that future Packards are going to be low, low jobs.

Golden Hawk is flying high . . .

Studebaker's new Golden Hawk sports car is getting a better-than-anticipated reaction from the buying public.

Wildest hopes of Stude production men were for a run of 10,000 cars. Now it looks as if the Hawk will sell easily that many. Design of the Hawks won't change much in the next two or three years.

Four models come in factory prices ranging from $1900 to $2800. This means actual delivered price of the top job will be nearly $4000.

AMC's hopes are on the Rambler . . .

The little car that isn't so little any more, the Rambler, is carrying the ball for American Motors Corp. It's expected to sell around 150,000 in 1956. Even more, if AMC's plans to woo taxi companies, fleet owners, and the export auto market turn out well.

American Motors' pocketbook looks like this: in the last 10 years AMC and its components, Hudson and Nash (including Kelvinator) have spent $250 million—now, AMC plans to spend $70 million in 1955-56.

It splits up this way: $10 million for Kelvinator appliances — mostly on product development and productioin; $21 million for the new Rambler line (already spent); and about $37 million between Nash and Hudson for new 1957 body changes. That leaves about $2 million unaccounted for.

AMC will begin using its own V-8 engine in the Hudson Wasp and Nash Statesman, replacing the six-cylinder engine. The big V-8 AMC now buys from Packard will be retained in the Hudson Hornet and the Nash Ambassador.

But you can look for AMC to drop Packard engine buying just as soon as its new V-8 line in Kenosha can produce for the whole AMC line.

Shorter work week?

That's what Detroiters think will be Walter Reuther's next big move—when the current so-called guaranteed annual wage contracts expire in 1958.

He'll start machinery going on this immediately, with a 32-hour week with 40-hour pay as the goal.

This may be the first really big test of the strength of the newly merged AFL-CIO. Reuther would like to get it in to somebody's new contract before 1958. It would give him a real club when the 1958 auto industry talks come up.

Another Reuther battle will be over more social security and some form of national medical or health insurance. Reuther wants social security benefits to start at 60.

He's willing to really go to the mat on this one — enough to squeeze-play the administration into liberalizing Social Security benefits before next year's elections. Reuther wants industry to pick up most of the Social Security tab.

Skilled trades are restless . . .

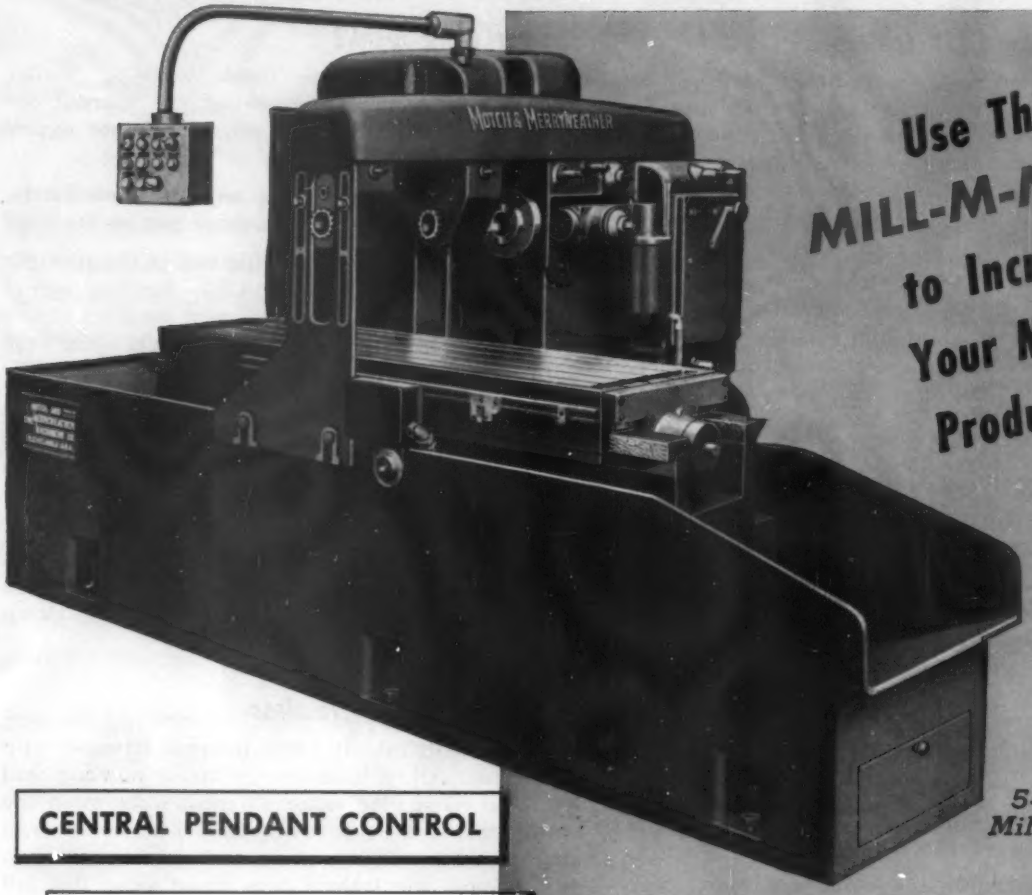
AFL-CIO will inherit CIO's internal struggle with dissatisfied skilled tradesmen, who are howling mad over the narrowing wage differential between the skilled man and the production worker—so much so that some 40,000 tool and die and maintenance men in the Flint and Detroit area broke away this fall to form their own union.

The AFL-CIO merger should bring this dissension to white heat—particularly because AFL's skilled men always made more than CIO's. But Reuther has promised to weed out the skilled from unskilled now that the merger is a fact.

Detroit tidbits . . .

Harlow H Curtice turned out to be the best crystal ball man in the business. In January 1955 he said that if labor and management stayed "peaceful" the auto industry would build 6.8-million units. Then in April he upped his guess to 7.5 million. The U S and Canada will produce about **9.8-million** units this year—8 million of them U S-assembled passenger cars . . . The **Continental Mark II** people now reveal that the Mark II prototype was built by **Hess & Eisenhardt,** Rossmore, Ohio, custom body builders . . . **Ford** is making its documentary film on crash research available to schools and organized groups throughout the U S . . . **Lincoln's** new national headquarters will be a 90,000-a-year plant at Novi, Mich, slated for completion by mid-1957.

Justly Named—the Motch & Merryweather MILL-M-MATIC BED TYPE *Production* MILL



Use This MILL-M-MATIC to Increase Your Milling Production!

Model 5-M-1842 Mill-M-Matic

CENTRAL PENDANT CONTROL

25 H. P. SPINDLE DRIVE

MECHANICAL TABLE FEED

AUTOMATIC TABLE CYCLES

RIGID OVER-ARM

You owe it to your production program to get all the details on this new *heavy duty* series of bed-type Mill-M-Matics. They utilize 25 horsepower through the spindle drive. Electrically controlled movements are mechanical to insure maximum rigidity and effective production with accuracy. . . The new Mill-M-Matic is now offered in a full range of heavy duty sizes by Motch & Merryweather, foremost builder of *traveling head* milling machines.

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Builders also of Circular Sawing Equipment, Vertical Turning, Automatic and Special Machines

Machine Tools . . .

Record orders for machine tools . . .

The machine tool industry comes up to 1956 in a much stronger position than it was in at the beginning of 1955. Orders for the past year promise to be around $825 million. That sets a new record for a peacetime year. The record was attained without substantial help from government business or export sales.

It now seems certain that new orders for the calendar year will outrun shipments by as much as $150 million.

That is why backlogs have been rising for some months. New orders should be in as large volume, in dollars, during 1956 as in 1955.

Production will be increased, of course. It may well get up in the neighborhood of $1 billion. In any event, it appears certain that machine tool shipments in 1956 will set a new peacetime record.

Engineering departments of machine tool builders are one of the main bottlenecks today. The handling of inquiries and processing of orders are being governed by the engineering staff capacity.

Never in history, possibly barring wartime, have so many builders been so flooded with inquiries.

Builders of forming and shaping machine tools (non-metal-cutting types) are, and have been, enjoying a tremendous business.

Best clue to the situation is the recent Washington release showing that backlogs have risen steadily until at the beginning of the fourth quarter the total was equal to 17½ months of business at the September production level.

Pinned down to dollar figures, unfilled orders at that time amounted to $280 million, compared with $165 million the previous year.

Fourth-quarter results will reveal a continuation of the earlier trend, with new business exceeding shipments by a healthy margin.

The third quarter was a breath-taker. New orders ran up a total of $123 million. Shipments in the same period were only $45 million.

Air Force to spend $52.9 million . . .

The Air Force has officially confirmed the news first published on this page on December 5 that it will spend $52.9 million for long lead time machine tools to be put to immediate use when delivered to contractors' shops.

Orders will be for the same machines involved in the Reserve Program: skin millers, profile millers, heavy bed-type and knee-type millers, horizontal boring mills, vertical turret lathes, broaching machines and stretch presses.

Russia and automation . . .

Russia's policy of design standardization lends itself to the greatest use of automation, since almost unbroken runs of the same component justify the high initial cost of the equipment, A M Krigeur, chief designer of the Stalin Auto Works, said recently after a recent three-weeks' visit to plants in the British Isles.

The machine tool industry in Russia, in line with this policy, is trying to develop a number of universal drilling and milling heads as basic units for transfer lines.

The industry also is working on individual multi-station automatics which can be coupled by appropriate conveyors and loading devices.

The ZIS plant is now installing new machines of these types. It plans to double its output with the same floor area.

Transfer lines for truck and car cylinder blocks, flywheel housings and transmission cases are in operation at the Stalin (ZIS) Works.

Russia's celebrated automatic piston factory now turns out 3500 pistons a day with only nine workers on each of the three shifts.

Tool makers expand UK operations . . .

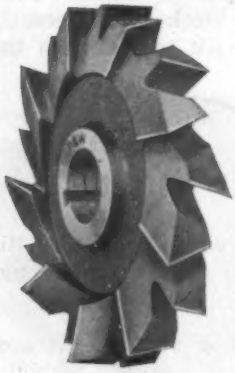
An increasing number of US machine tool and cutting tool makers are setting up manufacturing operations in the British Isles. Others, already established there, are adding facilities.

Cleveland Twist Drill Co will produce cutting tools in a new factory at Peterhead, Scotland. It will have a floor space of 50,000 sq ft and will employ about 100 people. Output will be sold throughout the sterling area. The plant will be ready in about a year.

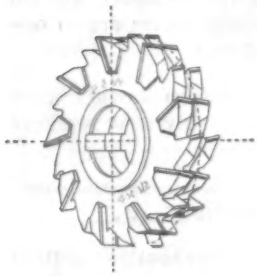
Ex-Cell-O's British subsidiary at Leicester will triple the existing factory space devoted to machine tool building. Some 18 boring machines have been produced up to now, but the line to be made in England will be broadened shortly.

Cincinnati Milling Machine Co is in the midst of construction of a major extension to its British subsidiary located at Birmingham.

All New DESIGN in staggered tooth SIDE MILLING CUTTERS with traditional PRATT & WHITNEY high quality



OLD DESIGN



MANY COMBINATIONS POSSIBLE WITH NEW P&W DESIGN

All P&W Staggered Tooth Side Milling Cutters of the same diameter have the same number of teeth and all keyways are located alike. By simply grinding the mating hub faces, 2 or more cutters (of the same or various widths) can be interlocked side by side to produce a very wide choice and range of widths. The results are: greatly reduced inventories, fewer special orders, fewer delays, greater convenience and lower tool costs. (Notice too the new raised lands on all cutting edges to permit faster and more economical grinding.)

PRATT & WHITNEY COMPANY
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MACHINE TOOLS • GAGES • CUTTING TOOLS

PRATT & WHITNEY Conducts Double Edged Research Program

BUILDS FOUNDATION FOR FUTURE IMPROVEMENTS AND SOLVES EVERY-DAY PRODUCTION PROBLEMS

However complex any machine tool may be, it remains basically a device for driving a cutting tool (or tools) in a desired relationship to the workpiece. And it is always the efficiency *of the cutting tool itself* that ultimately determines how quickly, accurately and efficiently industry can machine metal.

To provide industry with better cutting tools capable of delivering performance to meet today's and tomorrow's technical and economic standards, Pratt & Whitney has recently set up a completely equipped and staffed Cutting Tool Research Laboratory and has instituted a program of intensive scientific research.

Due to a significant lack of systematic research in the past, little is known about exactly what happens when cutting edge meets workpiece under various conditions. However, the P&W Research Program is now determining these basic machining facts and is rapidly creating a foundation of scientifically exact data essential to building improved performance into cutting tools.

Many of industry's machining problems are, however, more concerned with stockroom inventory and flexibility than with the scientific aspects of metal cutting . . . and the P&W Research Program is helping to solve these problems too with equal success. Here is a recent example: Manufacturers must often mill slots of widely varying widths. Stocking cutters for each width would be prohibitively expensive even if the various widths required could be anticipated; multiple cuts with cutters narrower than the slot are excessively time-consuming. Interlocking side milling cutters (*two* interlocking sections spaced by thin shims to mill slots to an exact width) have long been used, but each set provides a width range of only a few thousandths of an inch. Adapting this basic, interlocking idea, P&W designed an entirely new type of staggered tooth side milling cutter with all cutters of the same diameter having the same number of teeth and all keyways located alike. By simply grinding the mating hub faces, two, three, four *or more* cut-

(Advertisement)

ters of the same or different widths can be interlocked side by side. As a result, a relatively few cutters of various widths carried in stock can be assembled in various combinations to produce a very wide range of widths. Manufacturers benefit by reduced inventories, lower tool costs, fewer delays and special orders and greater convenience.

P&W Carbide Research Insures Right Tool Plus Correct Application

Progress in industry usually brings with it corresponding difficulties. The development and growing use of stainless steels and other new alloys and highly abrasive plastics have, for example, produced new machining problems. Fortunately, many of the solutions can be provided by modern cutting tool metallurgy. One of the well known solutions is carbide tooling. Where hard-to-machine alloys are involved, production records show that a carbide tool may last up to 200 times longer than a conventional tool of the same general design. Machining stainless steel with carbide tools, cutting speeds of well over 1000 feet per minute are now possible in regular production. Recutting "worked-out" forging dies, carbide tools now finish jobs in hours that used to take days.

Long realizing the great importance of carbide tooling, Pratt & Whitney has for the past 10 years conducted a program of intensive research in this field. From the first, this research clearly demonstrated that, while carbide was indeed the *potential* answer to many of industry's metal cutting needs, its successful application presented many difficult problems that could not be solved by simply adapting old rules. An entirely new basic foundation of metallurgical and applicational data had to be established.

The Pratt & Whitney carbide research program *has* provided this foundation of scientifically accurate data and has applied it successfully to the new, expanded line of P&W Solid Carbide Cutting Tools. As a result, Pratt & Whitney is in a position to provide customers with (1) The *right carbide tools* — correct in design and proper grade of carbide — for each specific application and (2) The *right operating instructions* — including correct speed, feed, horsepower and machine setup data — to insure maximum production, accuracy and finish.

(Advertisement)

When it comes to SOLID CARBIDE

PRATT & WHITNEY offers YOU the RIGHT TOOL... for Your Job

Lasting up to 200 times longer than high speed steel and able to lower production costs tremendously, carbide *IS* the tool of today and tomorrow!

But — you *can not* simply remove the high speed tools and replace with carbide. Additional power is required to drive carbide efficiently; speed, feed and chip load must be carefully correlated with type and depth of cut, finish required and many other factors. The correct grade of carbide for *each* application must be determined.

Now — traditional Pratt & Whitney cutting tool know-how and experience, supplemented by a 10-year program of special research and development in carbides, bring you this assurance: the *RIGHT* carbide tools for your specific jobs. Send us your work blueprints and acquaint us with type of machines involved. We will be glad to submit our job recommendations.

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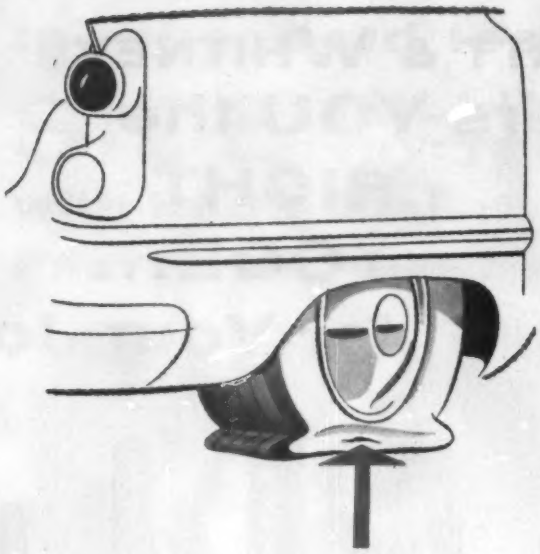
MACHINE TOOLS • GAGES • CUTTING TOOLS



a hole here is a letdown . . .

a hole here is a lift

Crucible Hollow Tool Steel Bars can step up output on most any production line where ring shaped or hollow parts are made. Why? Simply because the hole is already there. There's no need for drilling, boring, or hole-sawing. And that's where you save production time, increase machine capacity, and avoid scrap losses!

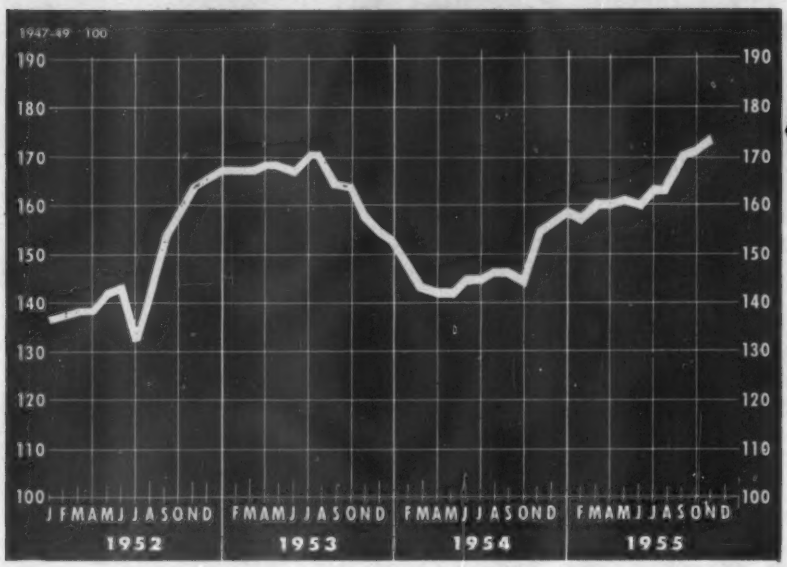
Crucible's famous tool steel grades are available to you in hollow form, in almost any combination of OD, ID and length. In fact, your local Crucible warehouse can give you immediate delivery of these popular grades — KETOS oil-hardening, SANDERSON water-hardening, AIRDI 150 air-hardening, and NU DIE V hot-work tool steels.

Ask your local Crucible representative how you can save time and money by using Crucible Hollow Tool Steel Bars. Call him today, at our nearby Branch Office. *Crucible Steel Company of America, Henry W. Oliver Building, Pittsburgh 22, Pa.*

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

Gaging Metalworking . . .



Production Index

BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	NOV. Estimated	OCT. Preliminary	SEPT. Revised	OCT. Year Ago
Total Index	**174**	**173**	**171**	**149**
Machinery	**144**	**141**	**124**	
Electrical Machinery	**204**	**205**	**197**	
Autos	**123**	**133**	**90**	
Other Transportation	**360**	**334**	**294**	
Other Metalworking	**144**	**143**	**126**	

AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

"Astonishing strength" . . .

Metalworking operations are showing astonishing strength for the year-end.

Whereas normally production diminishes as the holiday approaches, no such action has occurred this year. December, with due allowance for holiday shutdowns, promises to be up to the November pace.

American Machinist Production Index has gone up gradually but continuously since September.

It registered 171 then (1947-1949 = 100), 173 in October and is estimated at 174 in November.

This extraordinary showing comes from all segments of the metalworking industries. The automobile industry, to be sure, has been setting new late-in-the-year records. But industrial and electrical machinery manufacturers have boosted their schedules too and have helped them boom.

Chief worry appears to be an inadequate tonnage of steel and of non-ferrous metals.

The tip-off comes from the steel warehouse people who say that they are finding it increasingly difficult to get certain types of steel and that deliveries in the first quarter will be well below the demand.

Automobile parts makers are sanguine about the first half of next year. They foresee a continuation of record-breaking business. There is no sign whatever of a slowing down of parts releases from Detroit; what's more, none is anticipated.

Aviation parts companies, by contrast, are rolling along at a pace considerably below the year-ago rate. Some firms' output is as much as 30% off.

Stamping manufacturers are working close to capacity. Main complaint stems from inability to get all the steel they want. Some firms are turning to steel warehouses for tonnage, thus increasing costs but assuring an adequate supply.

Stamping orders are coming from all directions—home appliance makers, machinery builders, radio and TV people, automobile companies.

Screw machine products industry is ending the year about 28% ahead of 1954 in sheer volume. Even better, the first quarter looks mighty good.

Diversity is good . . .

The diversification of business is the best in a long time, with the construction industries and Detroit contributing heavily to orders. Average backlog is around 8-9 weeks (which is considered very good). Shipments about balance orders, hence no further lengthening of deliveries seems likely.

There has been quite a lot of price shopping by users of screw machine products; competition is keen.

With railroads plunking down big orders for freight cars, the steel casting industry is going into an active period (normally 30% of steel castings are taken by the railroad-car industry).

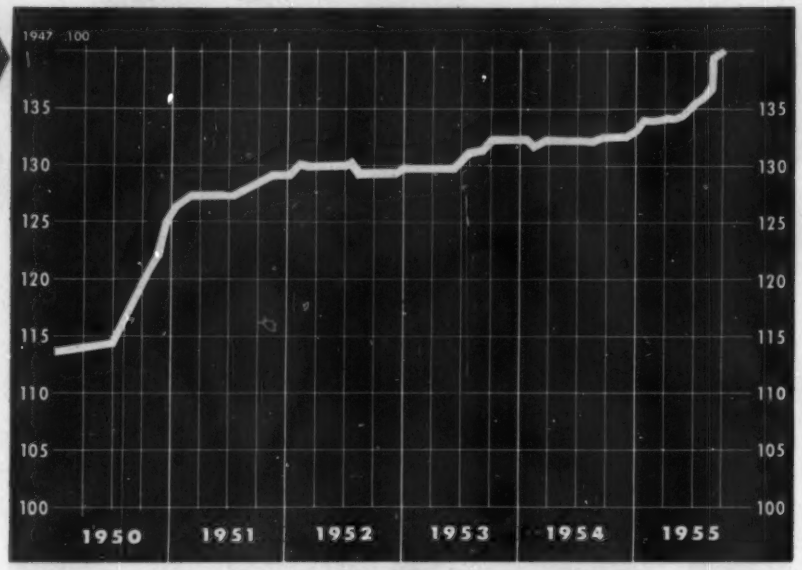
The first quarter promises a gain of 40% over '55.

Railroad car builders are faced by a bonanza. Cumulative orders total some 154,000 units; and current production amounts to only 6000 a month. Thus 1956 should be a plush year for the industry.

Gaging Business . . .

Price Index

	NOV. Estimated	OCT. Preliminary	SEPT. Revised	OCT. Year Ago
Total Index	**140.0**	**139.8**	**139.0**	**132.7**
Metalworking Machinery	**157.2**	**156.9**		**143.1**
Other Machinery exc. Electrical	**146.4**	**145.2**		**137.6**
Electrical Machinery	**136.2**	**136.0**		**130.3**
Fabricated Metal Products	**134.6**	**132.9**		**129.0**



AMERICAN MACHINIST INDEX OF METALWORKING PRICES

The outlook for '56 . . .

1955 has been a year of records—U S Gross National Product, personal income, and industrial production are at all-time highs.

And we'll go into 1956 on a rising wave of prosperity, but it won't necessarily take the form of an even progression from quarter to quarter.

Watch out for stumbling blocks in 1956. Anytime a boom picks up as much speed as this one, there's a good chance it will trip somewhere along the line—but it should recover fairly fast.

A case in point is the outlook for the automobile industry. A production pace of 2-million cars in the the first quarter, coupled with industry estimates of 7-million units for all of 1956, could mean a painful letdown at some time next year for the industry and its suppliers. And enough of the U S economy is geared to automobile production to make its effects fairly widespread.

But the effects of a drop in one industry, or in one segment of the national economy like farm income, wear off pretty quickly in today's economic setup.

One reason the American economy is running so smoothly is that today we have "rolling readjustments" in prospect—like a rise in capital goods buying offsetting possible automotive declines.

Even if the current boom gets a bit out of hand in the months ahead, America's growth potential (Gross National Product increases 4% a year) is such that the trend will be upward again before 1957 is over.

In a nutshell, prospects are good not only for 1956, but for several years to come.

Business is in a spending mood . . .

Historically, the most unstable element in our economy has been business investment in new plant and equipment. That's all over now. From here on out capital goods spending will be expanding at a relatively stable rate.

A major stimulus to expansion is the tremendous upsurge in research. Today we are spending $4 billion a year—four times as much as in 1920-1930.

WEEKLY BUSINESS INDICATORS

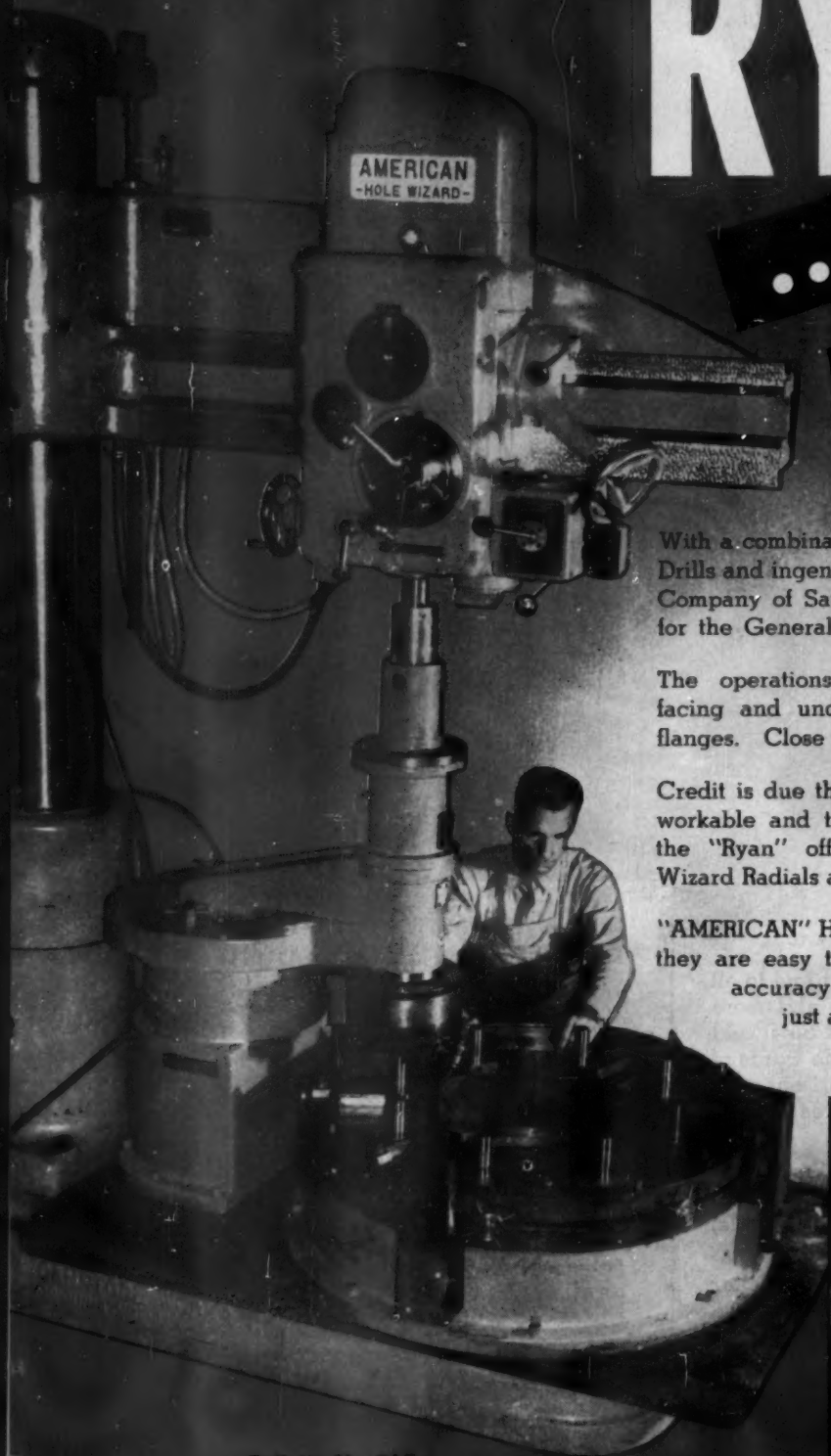
	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-49 = 100)*	148.9	149.1	133.1
Steel ingot production (thousands of tons)	2,384	2,356	1,958
Electric power output (million kilowatt hours)	11,359	10,727	9,612
Production of automobiles and trucks	217,701	181,089	171,177
Engineering construction awards (*Eng. News-Record*, millions)	$330.3	$278.8	$258.3

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Refrigerators sales (thousands of units)	313	311	272
Vacuum cleaners sales (thousands of units)	308	256	238
Washers sales (thousands of units)	415	404	380
Household electric ranges sales (thousands of units)	101	76	100
Radio production (thousands of units)	1302	948	931
Television production (thousands of units)	940	648	948
Gear sales index (1947-49 = 100)	246.5	217.6	135.1
Foundry equipment new orders index (shipments, 1947-49 = 100)	156.7	134.0	68.3

*Seasonally adjusted

RYAN ...HITS THE JACKPOT!

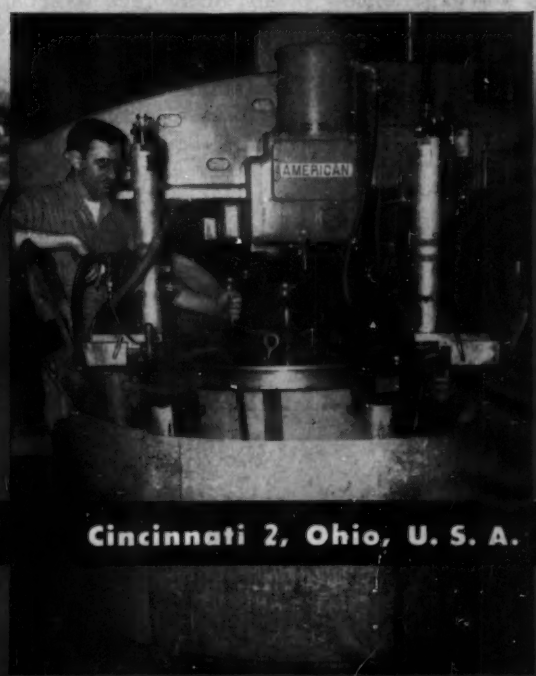


With a combination of "AMERICAN" Hole Wizard Radial Drills and ingeniously designed fixtures Ryan Aeronautical Company of San Diego, California, produces Aft Frames for the General Electric J-47 jet engine in record time.

The operations performed include precision boring, facing and undercutting of the stainless steel support flanges. Close tolerances must be and *are* held.

Credit is due the "Ryan" engineers for developing such workable and time saving fixtures. Credit is also due the "Ryan" officials for selecting "AMERICAN" Hole Wizard Radials as part of the "winning combination."

"AMERICAN" Hole Wizards are sturdy; they are powerful; they are easy to operate and they retain their original accuracy for years to come. For substantiation just ask the operator.



Bulletin No. 318
will give you the facts.

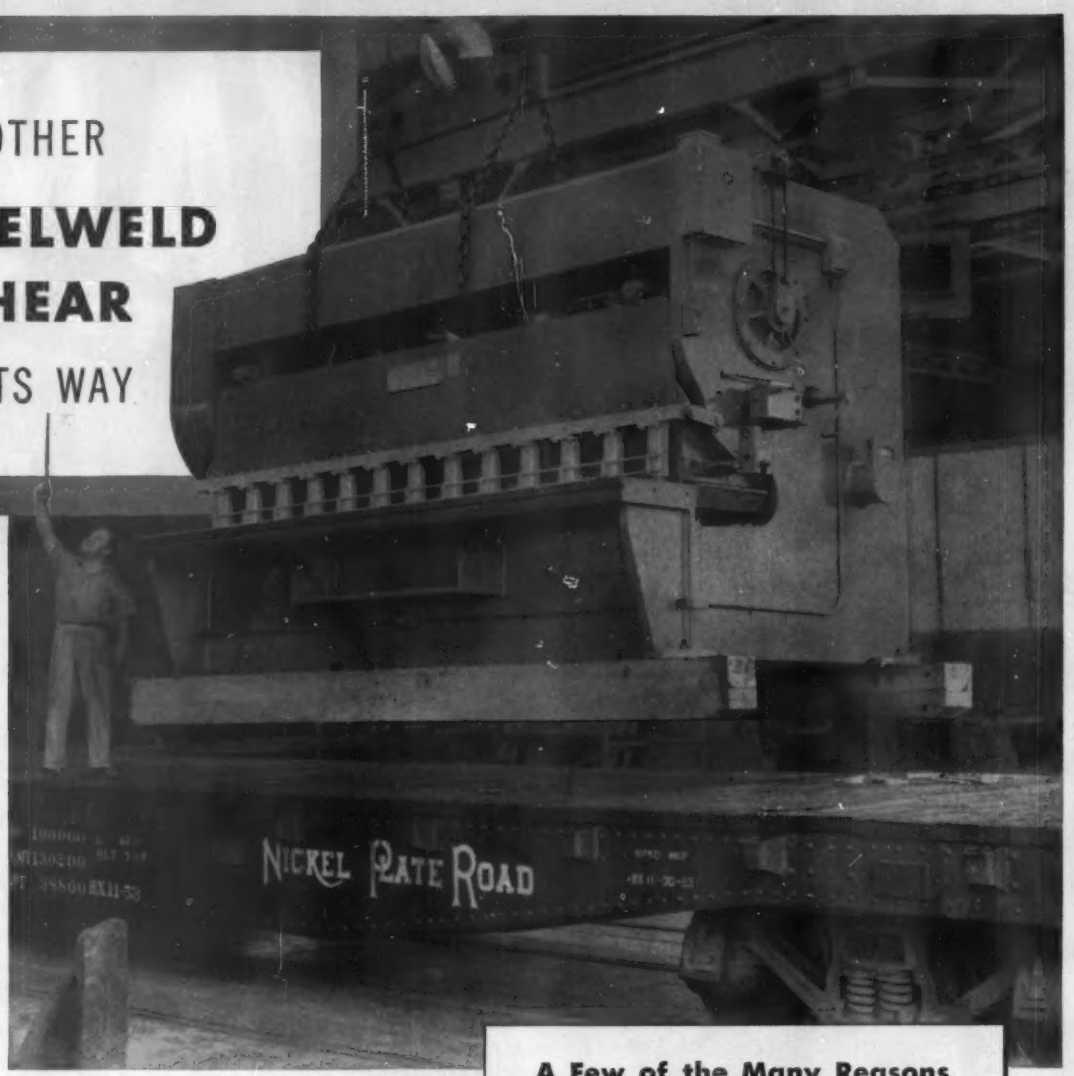
THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

ANOTHER

STEELWELD SHEAR

ON ITS WAY



From every angle a Steelweld shear looks good — and is good. This machine is rated for 12'-0"x½"steel

SHIPMENTS are being made at a rapid rate to all parts of the country because more and more users are learning of the many merits of Steelweld Shears and are talking about them. As the words of experience spread about and comparisons are made, more and more people come to realize that Steelweld Shears are really outstanding.

For smooth, accurate burr-free cutting, Steelwelds can't be beat. For ease of operation they have no peer. Their heavy construction and means for simple, easy maintenance assure long trouble-free life.

For the finest in shearing, you can't make a better selection than Steelweld. Say the word and we'll have one of these wonderful machines on the way to you.

A Few of the Many Reasons For STEELWELD'S DEMAND

1. Pivoted-blade operation. Entirely different from every other shear. No slides or guides to wear and cause inaccuracies.
2. Micro-set knife adjustment. Quick easy knife-clearance adjustment for every plate thickness. Something not matched elsewhere. Be sure to get the complete story on this.
3. Mechanical hold-downs. Tight gripping, non-leaking, quiet operating.
4. Accurate easy operating back gauge rides on ball bearings.
5. Cool-operating, long-life, low-inertia clutch and brake.
6. Heavy all-welded rigid one-piece steel frame.

AVAILABLE FOR PLATE LENGTHS TO 24 FEET AND THICKNESSES TO 1½ INCH

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STEELWELD PIVOTED BLADE SHEARS

American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

A "Must"—More Skilled Men

That there is an acute shortage of skilled men in Metalworking is hardly news. Most disturbing of all, the situation is sure to get worse before it gets better.

Reasons for the shortage are apparent. For one thing, the differential between the wage rate of the skilled worker and of the unskilled worker has been slowly but steadily whittled away for the past twenty years. It is smaller now than ever.

Beyond that, the lure of becoming a so-called white-collar employee has been powerful among the class of men from which skilled workers logically would be drawn. Somehow, an employee feels that he has "arrived," that he has attained a higher economic and social status, if he graduates out of the shop.

Metalworking management must take a good share of the blame for the shortage. It has been guilty of gross negligence in allowing training programs to drift along or die on the spot. It has been content to improvise in tight situations rather than go to the trouble of setting up and operating sound apprenticeship programs.

All of this has happened at a time when more skilled men are needed than ever before. As one looks ahead, special skills will be at a greater premium than they are today. **The age of mechanization will inevitably bring with it a demand for more technicians. It is the unskilled man, not the skilled, who will be a casualty of progress.**

Recognition of this fact imposes upon the metalworking industries and upon our educational system a tremendous responsibility. Metalworking must have a larger supply of skilled men if it is to operate efficiently.

The question is: What can be done to improve the situation as soon as possible? Fortunately, there are good answers.

First, management should think in terms of widening, not narrowing, the differential between the incomes of the skilled and unskilled. Unless a reasonable margin is maintained, the incentive for becoming a skilled man disappears.

Second, study the possibility of upgrading your more promising young men. Perhaps you should set up special classes or special courses for them. Give them plenty of attention in developing their potentialities. Some outside help in such training might be advisable — help from professional counselors or local technical schools.

Third, establish apprentice training courses, with adequate physical facilities and experienced supervision, wherever and whenever justified. If your company is small and you feel that you cannot go it alone, consider a group training program in your community or in your region or in your industry.

The Engineering Industries Association in England has evolved a cooperative plan that is being put to work on a national scale. It is designed to enable small companies to give sound training to apprentices equal in quality to that offered by big companies.

Fourth, management should give close attention to ways and means of giving constant and warranted recognition to skilled workers. If this is done intelligently, it will go a long way toward rekindling the pride that skilled men once had in their jobs.

Unless the metalworking industries wish to court serious trouble in the years ahead, **the time to begin a comprehensive program of training skilled men is now. A few national associations and a handful of individual companies have the matter well in hand. But they are in the minority. Not until the problem is dealt with on an industry-wide basis will Metalworking be assured of enough skilled men to meet its future enlarged requirements.**

Burnham Finney

EDITOR

Here a Cincinnati Press Brake saves 3 ways...

Built at The Maryland Drydock Company, for the Westinghouse Electric Corporation these giant condensers are some of the largest ever constructed.

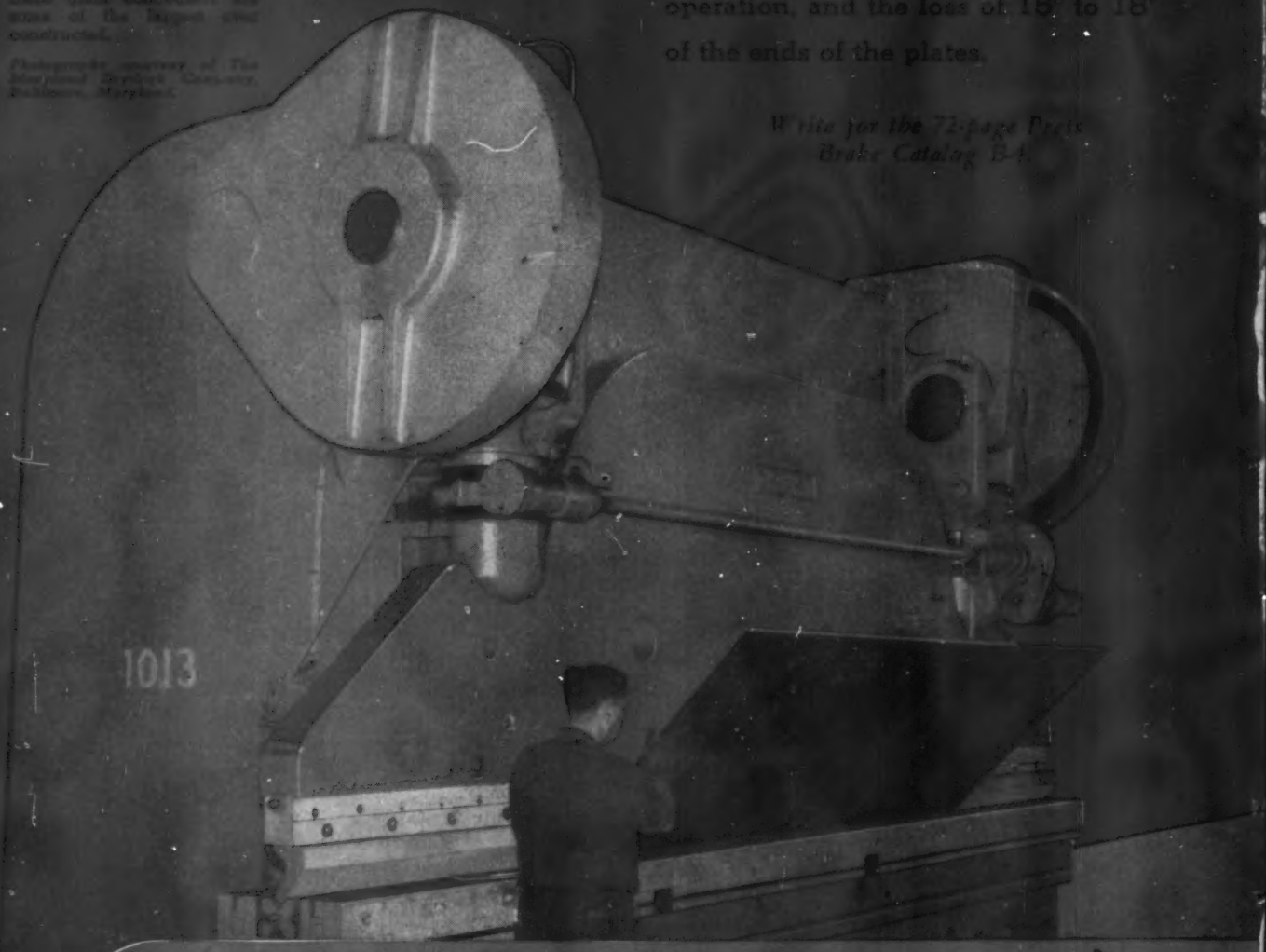
Photographic courtesy of The Maryland Drydock Company, Baltimore, Maryland

- TIME
- NUMBER OF OPERATIONS
- MATERIAL

Crimping plate up to 3" thickness has cut roll-forming time in half at The Maryland Drydock Company.

The press brake crimps the ends of the plates with special dies, and has eliminated both the costly burning operation, and the loss of 15" to 18" of the ends of the plates.

Write for the 72-page Press Brake Catalog B-4



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Vacuum metallizing

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ROBERT N SHEETS
WILLIAM M STOCKER, Jr
associate editors

On the eve of Christmas, toys have a special significance to almost everyone. They bring joy, surprise, excitement, wonder, and a galaxy of other emotions. Why? Perhaps because toys are the fulfillment in miniature of otherwise unattainable desires. Thus, sparkle, color, and realism are important ingredients for enjoyment. Here is how Santa Claus' helpers, with a simple Metalworking touch, accent the wonder that is Christmas

Today's toy business isn't child's play. It's a rough, tough—often cut-throat business—where you've got to stay one jump ahead of competition, where your last-season idea becomes your competitor's this-year idea because he's taken it and added a gimmick or two.

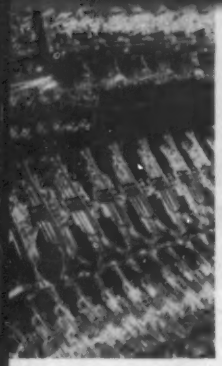
It's the gimmicks, the little extra touches, that count in the toy business. The kids and their parents who buy them want realism. You can't get by any longer with the cheap plastic stuff that flooded the market just a few-years back. Plastic toys were a novelty then, and a lot of toy-makers reaped the harvest by mass-producing articles that had about as much detail as a lump of clay. The result: "plastic" became synonymous in the toy trade with "shoddy."

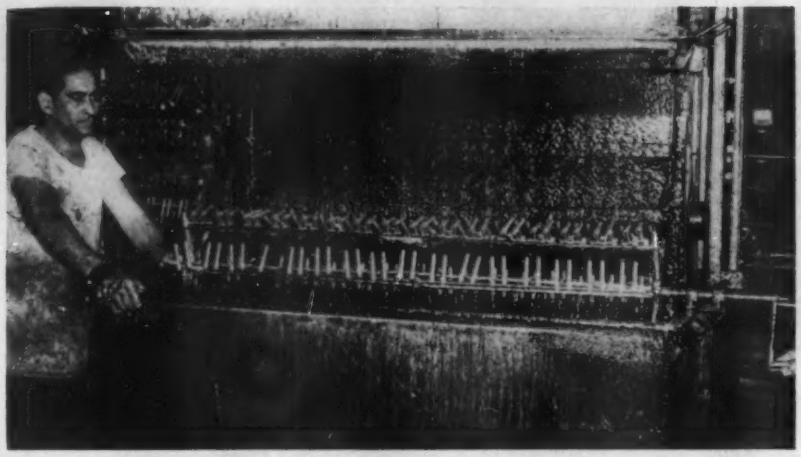
Plastic toys have had a pretty bad history to live down, and it's only been in the last two or three years that they have come into their own as "class" items, but today's models, some of them costing $12-15, are a far cry from the first sloppy dime-store stuff.

Plastics are the coming thing in the toy-making industry. They're lighter, easier to make, and you can get detail into them that would be prohibitively expensive in metal. That's why Long Island's Ideal Toy Corp is one of world's biggest—if not the biggest—plastic toy manufacturers. Today, 95% of its output is in plastic. Metal is used solely as a backing where strength is needed, and in motors for wind-up toys.

Today's plastic Ideal toys, things like a toy fireboat that squirts water from several nozzles, a coin-operated pay telephone that says "What number please?", a truck that tows a car with a damaged fender that can be replaced with a little tool, automobiles with wheels that can be changed—all demand realism to a degree never before approached in toydom. That's where vacuum metallizing, the Midas touch that makes plastic look like gold, and makes handsome profits for the toy manufacturer, comes in.

Ideal first started using vacuum metallizing to pretty up its toys back in 1948. The idea was to do something to overcome the richly deserved public prejudice against plastic toys. Vacuum metallizing at that time was in its infancy. A man doing custom metallizing (things like spray-metallizing baby shoes) made





1 . . Parts come from molding . . .

in cartons; are fixtured and racked. Then base coat of lacquer is applied by dipping, with setup shown. Lacquer is thermosetting synthetic resin, selected to provide a smooth surface that will not bubble or de-gas under 10-micron vacuum. Rack is rotated in dip tank to evenly coat parts. Exhaust hood above tank removes solvent vapors. If parts contain cavities that will trap lacquer, coat is applied by spraying with a gun

up some samples, which were tried out on the trade. Response was fantastic, buyers couldn't believe the toys weren't metal, and orders piled up on Ideal's books.

Trouble was that the custom metallizer wasn't set up to handle large volume. So, while the orders piled in, the output was discouragingly slow and orders began to be canceled as fast as new ones came in. Result was that Ideal gave up the idea. The firm had proved that vacuum metallizing sold toys, but by that time plastic toys were improving to the point where they were overcoming the public's prejudice against them. Metallized toys were shelved for about five years.

But in 1953, competition in the toy-manufacturing industry had become so keen that something had to be done about keeping Ideal ahead of the pack. Someone thought of trying vacuum metallizing again. It worked before, why not now? Only this time Ideal would operate its own equipment instead of relying on inadequately equipped suppliers.

First vacuum-metallizing purchase was a Stokes 48-in. unit. It was a huge success right from the start. By owning its own machine, Ideal could control its own production schedules instead of having its output sandwiched in between other customer's jobs, and the company could develop its own techniques. In less than a year, Ideal found that it had more work than the 48-incher could handle, and bought a 72-incher from Stokes.

This gave Ideal a pretty good edge on its competitors. The company could go in for bigger, more elaborate and more expensive toys than it ever had before. For instance, the average price of a plastic toy (not metallized) was under 50¢. Today, metallized plastic toys bring an average price of $3—anywhere from 10¢ for a knife, fork or spoon to an aerial ladder fire engine that sells for $12.

Ideal's vice president, Lionel A Weintraub, who heads up the company's Plastic Division, isn't the least bit hesitant in giving much of the credit for the improvement in plastic toys to vacuum metallizing: "It has given us the added realism and beauty of finish you've got to have in higher-priced toys. Today's kids are plenty critical. They've got a sharp eye for detail and they want a thing to look real. Metallizing gives it to them."

"To give you an example," he says, "we had a set of sherbets and water glasses with a serving tray, sort of things little girls use for their dolly tea parties. We used to sell maybe 50,000 to 60,000 of them a year. Then we had the idea of metallizing the whole thing, just to make it look shiny and pretty. Within one year, sales ran to 200,000 —at double the old price.

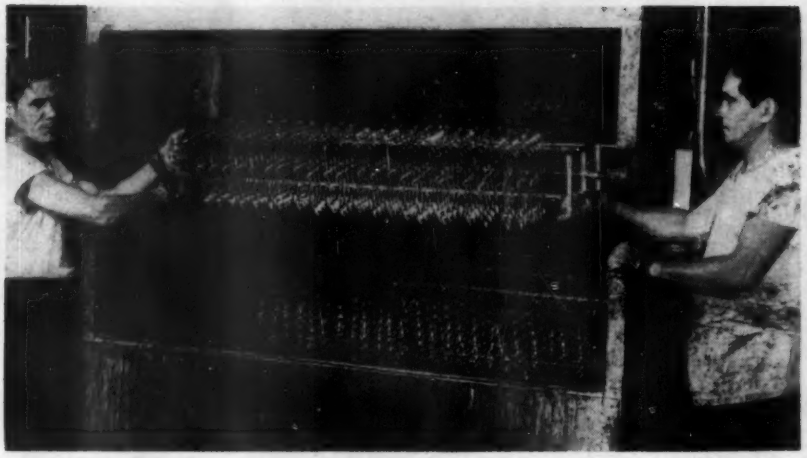
"That's what happens when you metallize the whole toy. Like our golden toy trumpets and saxophones. Look like the real thing, and they sell like hotcakes. But sometimes we use metallizing just as an accent —like the realistic fittings on the fire boat—that's where it really counts. Here at Ideal, we use metallizing as an adjunct to an entire toy: as a design accent rather than as an entire piece. On some big toys with 30 plastic parts, only five are metallized, but they're what make the toy live."

Metallizing will be Santa's helper this Christmas on such toys as saxophones, trumpets, toy soldiers; model tanks, jeeps and command cars (they're all fully metallized) and as an accent on Ideal's fireboat and fire engine, its tow truck and damaged car combination, speedboat, rocket ship, fix-it-yourself convertible, and many other "class" toys.

One interesting item Ideal is experimenting with is a sort of assemble-it-yourself-knight-in-armor-on-horseback. When and if the bugs are worked out, it'll be the largest all-metallized item on Ideal's list. It's not really a toy, more of a showpiece, standing about 15 in. high.

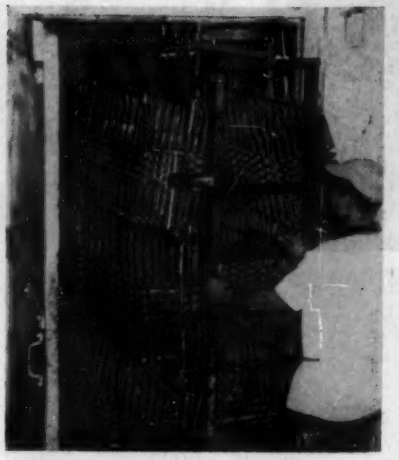
The realism of metallized finishes and parts is the prime selling feature of plastic toys, and it's a sales and eye-appeal tool that has boosted the Plastics Division from a backseat in Ideal's four-division setup (others: dolls, stuffed animals, inflatables) to a top position in just a few years. It's a prime factor in the almost-50-year growth of Ideal, a company that started back just after the turn of the century with the Teddy Bear.

Morris Michtom and his wife, both immigrants and the parents of today's Ideal Board Chairman Benjamin Franklin Michtom (old Morris was so grateful to his adopted land he named his oldest boy for a great American), ran a news stand back in those days. About that time, a newspaper cartoon showed Teddy Roosevelt refusing to shoot a little bear someone had dragged into his hunting camp down in Mississippi. The cartoon became famous as "Teddy's bear incident," picked up political connotation somewhere along the way and became associated with Roosevelt. Morris Mich-



2.. Mechanical rotator . . .

is used after dipping to drain off excess lacquer and further dry the solvent. This step also evenly distributes the lacquer over the part and reduces load on the drying oven, the next step. Rotator provides a double action; takes six racks at a time around a revolving spider and, in addition, each rack rotates. Following this operation, racks, or "spokes" as they are called, are hung on truck. Latter holds 6 to 10 spokes



3.. Oven drying . . .

is next step. Parts, on trucks, are placed in oven for 2 to 2½ hr at 150F. Oven must have good air circulation, good temperature control, and a good exhaust system to carry out solvent vapors

tom, an ardent admirer of the erstwhile Rough Rider, asked Mrs Michtom, who was also a spare-time seamstress, to make a doll of the bear, and the first Teddy Bear was born.

The Michtoms put it in their shop window. People admired it, asked if they could buy one. The Michtoms weren't sure they ought to make them to sell, so they wrote TR asking if it was OK with him. He wrote back yes. That was the beginning of Ideal Toys. Mrs Michtom tried for four years to keep up with demand, but the Teddy Bear grew in popularity, and four years later a shop was set up in Brooklyn. "We never copyrighted the Teddy Bear and we never paid a royalty to Teddy Roosevelt on it—if he had asked for say 5%, his estate would have cashed in on 15 million bears to date."

It was during World War I, that intensely patriotic Morris Michtom determined that a U S firm could make toys as good or better than the famous ones that had come from

4.. Metal finish . . .

a few millionths of an inch thick is applied by vaporizing pure aluminum, using tungsten filaments, in a high vacuum and allowing the aluminum vapor to condense on the parts. Here, spirals of 0.060-in.-dia aluminum wire are inserted into the coils of the tungsten filaments. The latter are positioned through the center of the spider that supports the fixtured parts in the chamber. Power is supplied through copper bus bars from contacts at the rear of the chamber. As aluminum vapor travels only in a straight line, location is critical

5.. Spokes are transferred . . .

from truck to spider which contains a chain drive for rotation that engages a power takeoff in the chamber. After loading, with parts fixtured to permit equal access of vapor, spider is rolled into chamber; then door is closed and sealed. Depending upon humidity, a ½-micron vacuum (10^{-5} mm Hg) is obtained in 15 to 30 min. of pumping

Vacuum metallizing . . .

6 . . Nitrogen bulb . . .

mounted on inside of door or in line to diffusion pump, speeds evacuation by condensing (scavenging) water vapor in the chamber. By evaporating liquid nitrogen, bulb temperature is reduced to –360F. Bulb is used only when high humidity greatly increases pumping time

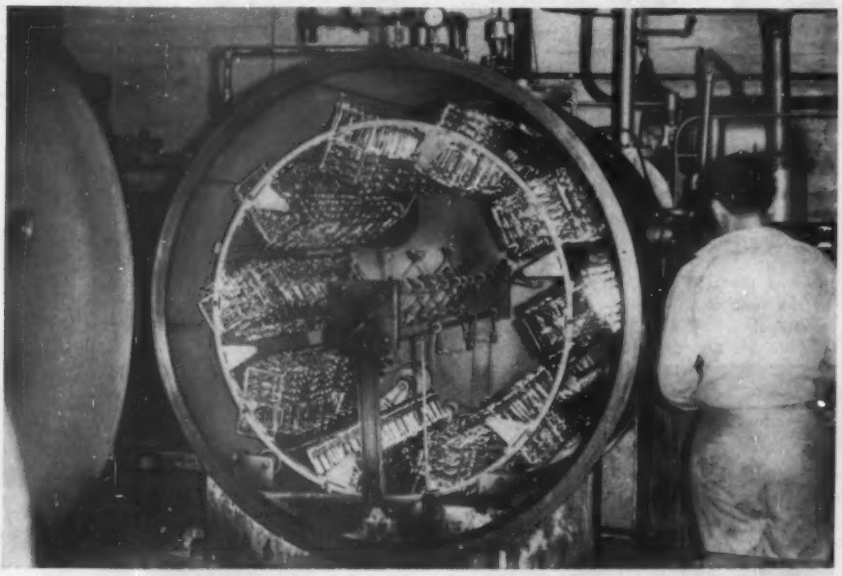
the then enemy, Germany. That's when Ideal branched out into dolls and other toys.

Today, Ideal has 750,000 sq ft in the old multi-storied Hollis, Long Island, plant bought from Ranger Aircraft in 1947, where upward of 2500 employees make more than a thousand different kinds of dolls and toys.

That's a long way from a Teddy Bear in the window of a news stand. It's meant a constant keeping-ahead-of-the-times. It's meant keeping a sharp eye on trends in juvenile tastes. This is an era of technological development and new frontiers in science, and it reflects itself even in the likes and dislikes of today's children. They want toys that are junior models of the real thing, be it an automobile with tires you can change, or a fire engine with an aerial ladder. Even if it's a toy trumpet, it must look real these days—metal has to look like metal. It must shine like gold or brass, or silver, and a toy has to be complete down to the last detail. Plastic molding can provide detail as never before, and it's vacuum metallizing that adds the final lustrous touch to the world of make-believe.

Only a few years ago, vacuum metallizing was a new discovery, a laboratory technique using a bell jar for a vacuum chamber. Limited to small pieces of costume jewelry and to metallizing ceramics to make printed circuits, some people called it "sputtering," (AM—July 7 '52, p147). Today it's big business. At Ideal, for example, the big Stokes machine is 72 in.. in dia by 60 in. deep. To get down to ½-micron vacuum you need two stages, first a 25-hp pump that gets the chamber down to 200 microns; then an oil diffusion pump for the fine stuff. A small aluminum flake on the door flange, or even a pinhole, is enough to prevent you from reaching the required vacuum. In principle, the chamber is similar to a gigantic electric-light bulb. Leaks are detected by an ionization gage. Operators wear white coats so color will not reflect from the mirror surface of the parts and interfere with inspection for complete coverage.

And toys are only one facet of this rapidly developing technique. Other applications include electronics, automotive accessories, household appliances, business machines, and decorative papers.



7 . . After firing . . .

which takes about 10 sec (depending upon load), chamber door is opened and spider is rolled out onto a railed support; then spokes are transferred to a truck and moved to dip tank for lacquering. Process is similar to pre-lacquering, Fig. 1, 2, & 3 except that top coat is clear thermoplastic synthetic lacquer so the metal will be visible and air drying is forced by only one hr in the oven, to speed output. All parts leave chamber with silvery aluminum finish, then color such as gold, red, green, blue is applied by dipping, after lacquering, in an organic dye (non-toxic) which is transparent to expose the metallic sheen. Dying is followed by a water rinse and then by a second rinse containing detergent (wetting agent) to prevent spotting. Parts are air dried. For a given dye concentration, color depth depends upon length of time in solution

8 . . Final step . . .

consists of removing parts from fixtures and packing them in boxes for shipment. Small parts are handled in clusters, as they come from the mold, while larger parts are individually fixtured. Parts are inspected as they leave the vacuum chamber and at this point. With 72-in. chamber, at 10 spokes per load and, under good conditions, three loads per hr, production is from one large to 100 small pc/spoke

American Machinist
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Surface metallography solves production problems

A T STEER, D Sc, consulting metallurgist, LONDON

When parts fail in storage or service, the responsibility may lie in how the surface was processed. Cleaning operations, localized work hardening, or incorrect surface finish may be at root of the trouble. But how can you isolate the fault?

The reasons for failure occur in a very shallow zone — from the surface inward to a depth of 0.0001 to 0.001 in. To find what you are looking for, you need high-power magnifications — say 2000 times. You can't look at the surface itself: you must study the edge of very carefully prepared metallographic specimens. From what you see and from deductive reasoning, it is possible to determine the real fault in processing and make suitable changes.

Here, then, is a powerful tool for production research — and one that will get answers impossible by other methods.

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how to select a specimen for examination

Selection of a truly representative specimen of a surface is not easy. An actual surface cannot be examined at high magnifications, because even for a gage block the degree of "flatness" is far from that desired. Hence, the only possible way to examine a surface is to section it and so observe its contour and the conditions obtaining at the surface itself, and their relationship to those found in the subsurface structure. Because this "section," is only around 0.001 in. deep, care must be exercised in choosing just what really constitutes a representative example of the conditions visible when the surface is scrutinized with a low-power lens.

An actual investigation will demonstrate the need for a careful visual examination before any section is actually chosen. Electroplated watchbands were sent to the author for metallographic examination, to determine the reason for partial exfoliation of the plating. The deposit was primarily heavy nickel on 60-40 brass followed by a thin chromium plate. After the product was stored the plating was found to be loose and had shed on some areas.

WHERE TO TAKE A SPECIMEN

In a case like this, it is difficult to isolate a portion of the affected surface and feel confident that the reason for failure can be found by examining the area selected. More pertinent information will be found if a section is taken where no exfoliation has taken place, because the seeds of the trouble will be in a state of partial development in this area. An area where exfoliation and obvious surface breakdown has occurred will doubtlessly reveal the base metal to be in a chaotic state of intergranular corrosion, which can be attributed to one of the following possible causes.

First, large residual stresses may be present in the surface of the base metal, or even in the plating.

Second, the cause or failure may be porosity, which would allow percolation of reactive fluids or gases through the deposited metal to the corrosive zone, which is a fruitful area for corrosive breakdown.

Third, the preplating cleaning processes may not have been adequate to assure chemical cleanliness, foreign matter has remained on the base metal.

Fourth, the 60-40 brass watchband stampings might be dezincified. This is a form of corrosive reaction which is "autocatalytic," because the reaction products break down and continue the action, which proceeds inwards into the base metal. The condition leaves the metal copper rich, accompanied by severe grain-boundary breakdown. If this layer of corrosion is removed prior to plating, the reactive cleaning fluids are trapped in the interstices. When plating is completed these fluids are adjacent to the interface, an ideal position to promote rapid corrosive attack. Polishing heats up these trapped active fluids and causes an accelerated action at the interface. The deposit is loosened, followed by exfoliation.

Thus, it is necessary to pin down which of the above causes is responsible for failure. An ill-chosen section will reveal intergranular corrosion, but too advanced for isolation of the real cause. Therefore, a section should be chosen that exhibits little or no evidence of distress in the plated layer.

To illustrate these conditions, two specimens were cut; one from the apparently unaffected portion of the plating, and the other from the loosened or partly exfoliated portion. The results were:

Adherent Plating—The dark layer on the surface of the base metal is not resolved at 1000 times magnification, Fig 1, but the intermittent nature of deposition associated with decorative chromium plating is clearly seen. The dark layer at the interface could be dirt, decomposition products from retention of reactive fluids, or cleaning sludge. By 3000 times magnification the dark layer is shown to be the beginning of interfacial attack by reactive matter, Fig 2. Possibly this came from a brightening dip, which makes the metal surface retentive of reactive fluids. This condition inevitably leads to exfoliation and can give rise to a delayed action, so that defects do not appear until after some time later.

From examination of Fig 2, it is seen that the nickel deposit is clean, continuous, and free of porosity. Thus, corrosive fluids cannot seep through. By deduction, the preparatory treatment of the base metal was at fault.

Exfoliated Plating—From examination of a section, Fig 3, where exfoliation has taken place, it is seen that the deposit has actually lifted, and all evidence for the reason has disappeared. Hence, the insistence that a section must be chosen only after careful thought and visual examination, preferably with a low-power lens.

Improved Plating—By changing the cleaning and preparatory methods *before* plating, a clean interface was secured, plus a well-adhering deposit, Fig 4.

HOW TO PREPARE A SPECIMEN

A machined or lapped surface on the selected *section* is absolutely unsuitable for high-power exami-

Plating failure traced to poor cleaning

FIG 1—Watchband section at adherent plating. Clue to trouble—dark layer *A* at interface. Details: *B*—0.001-in. nickel plate; *C*—intermittent decorative chrome; *D*—60-40 brass base metal. Magnification, 1000 X

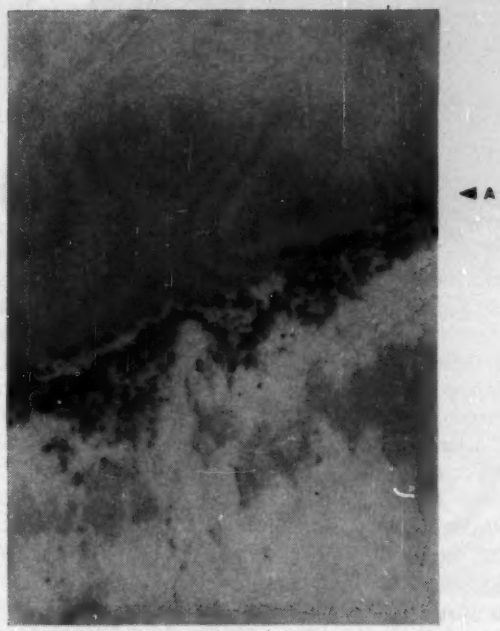


FIG 2—Dark layer *A*, examined at 3000 X, is found to be a zone of corrosive interfacial attack

FIG 3—Watchband section at exfoliated plating. Here the dark interfacial zone *A* consists of voids; the cause of trouble has done its work and disappeared. Magnification, 1000 X

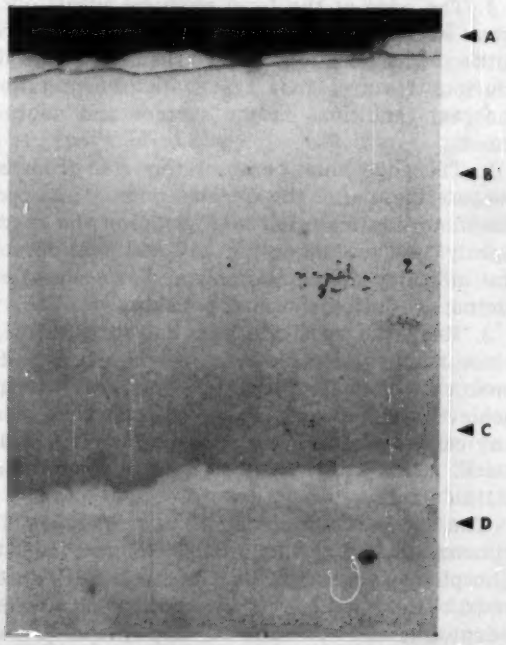


FIG 4—Improved plating practice. *A*—decorative chrome; *B*—nickel; *C*—Clean and sharp interface, and *D*—60-40 brass stamping. Magnification, 2000 X

Working changes surface properties

FIG 5—Flow layer *A*, 0.00009 in. deep, on fully annealed carbon steel was induced by power polishing. Striation occurred at *B* due to compacting. Weak etchant revealed work hardening but was not strong enough to bring out grain boundaries, as seen at *C*, which would mask the effect of working the surface layer. Magnification, 3000 X

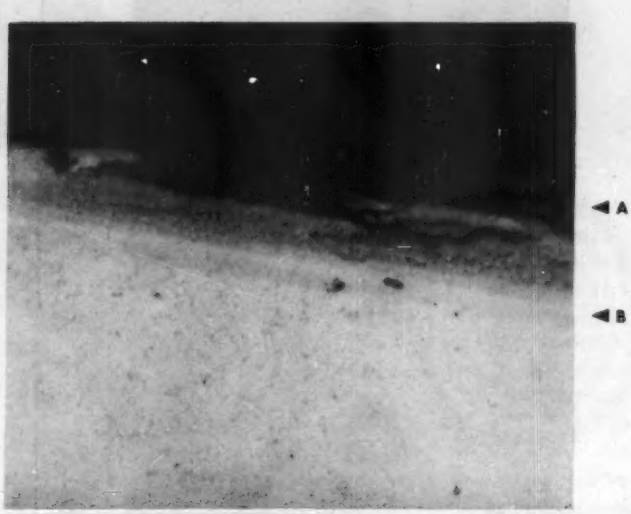


FIG 6—Fragmentation of a surface as at *A* is caused by wear induced by sliding friction. Depth of the true flow layer *B* is 0.00004 in. It is possible that the fragmented layer is smeared onto the true flow layer from the heavily worked surface of the mating part. Magnification, 3000 X

nation. The cutting of a section for surface examination calls for both care and patience.

The essential points to observe are:

1. The edge of the form must be absolutely free from extraneous distortion from sawing or from cutting with elastic wheels. Distortion introduces spurious features that aggravate interpretation of the real conditions in the surface and subsurface zones.

2. The edge must be absolutely free from burrs, because these alter the surface contour, and prevent the mounting material from gripping the specimen tightly. A slack mounting will add considerably to the difficulty of maintaining a sharp edge for examination during the final polishing.

3. Keep the specimen as small as possible, because it must be made optically flat. It is better to mount two small specimens than to attempt to achieve a metallographic polish on a large one. In any case, a section need never be more than 0.1 in. thick. An average specimen is ¾ in. long and about 0.1 in. thick.

The above conditions apply to most types of specimens, including such delicate forms such as a phosphate or sulphide films on steel. Each specimen must be dealt with on its own merits, and a technique adapted to suit conditions. The principal precaution is to cut the section well clear of the vital area. The best instrument is a jeweller's saw, which is gentle in its action and minimizes distortion. A set of instrument-maker's pliers and a well-made hand vise with fiber-faced jaws are invaluable when dealing with minute sections, such as fine needles or exceedingly thin wires and foils.

When the specimen is cut, all burrs are removed from the edges which are not being examined, using a Swiss file (No 1 or 2). The edge that really matters, that is, the one which must be capable of standing up to very high magnifications, is prepared for mounting by polishing the face with 320-, 500-, and 600-grit silicon-carbide papers. Hold the piece absolutely square between the finger and thumb, and lightly but definitely polish it on each of the above papers in turn.

Very minute sections like spindles of miniature-watch escapement mechanisms will need some practice before being of a standard suitable for mounting and polishing. In cases of this nature, the instrument-maker's kit becomes useful, and a bench binocular microscope of 15 to 25 power is indispensable.

Correct reduction of the cut face renders it perfectly flat and the edge burr-free. The actual surface containing the defect is scrutinized at intervals with a low-power lens. If the specimen is very thin, for example, a 0.001-in. foil, it can be kept supported upright by holding against a glass parallel strip while the sheared face is being reduced. The sectioned face must always be at right angles to the surface that is being investigated, otherwise all features present will be exaggerated. In the case of deposits and

surface films, lack of squareness will falsify the thickness.

The correctly reduced sectional face should be brilliant and flat, the edge common to the surface in question and the section should be sharp and continuous, and the section should be capable of standing upright on this face. The thinner the section, the more unstable it will be, but this can be overcome. A little 120-mesh Bakelite molding compound is placed on either side of the specimen, which is placed centrally on the platen, or lower portion, of the steel 1-in. dia mounting mold. The powder will hold the specimen upright when the outer mold cylinder is placed in position. Next, a measured quantity of powder is added to maintain the specimen and to cover it completely. The force is now pushed home and the mold compressed in the mounting press. No heat is applied at this stage, because the mold must be removed, the platen eased out, and the compacted powder examined, to assure oneself that the specimen is held correctly. If the specimen be tilted, as determined with a watchmaker's lens, the compact must be forced out and remade. If the compact is satisfactory, the mold can be reassembled, and the compact cured.

The completed molding is bevelled top and bottom, to aid handling when polishing and prevent the face "snatching" at the polishing cloth. A refinement, which is useful when a precise thickness must be removed from a section or when investigating a fault at several levels, is to surface grind the bottom face and hence allow the specimen face to be squared to it. By measuring with a micrometer, definite amounts of a section can be removed, and a defect in a surface can be surveyed critically in its depth, while important positions in a surface can be accurately located without undue examination. Many defects, particularly corrosion attack, can thus be followed a few thousandths at a time, and the data form a valuable aid when it is necessary to find why such a defect developed.

METALLOGRAPHIC POLISHING COMPOUND

This is the most difficult operation used to produce a satisfactory section. The abrasive must be correct both physically and chemically. Any reactivity of an aqueous suspension of an abrasive powder can affect the metal it is polishing. Thus, staining can be produced, or constituents attacked and dissolved, so that observation becomes impossible; or even the matrix of an alloy can be affected, which would obscure any trace of the original defect being sought.

To control its condition, the best procedure is to make the abrasive from chemically pure aluminum sulphate. The sulphate is dehydrated in porcelain dishes, then transferred to a fireclay dish capable of resisting at least 2100 F, and calcined in a gas-muffle furnace. Use a furnace with a tight-fitting door, having a small porthole. Seal the door with asbestos twine so that noxious fumes cannot escape. Insert a silica tube into the porthole but projecting about 8 to 10 in., so that heat-resisting rubber tubing and glass tubing can be linked up with a vacuum system, preferably one operated by a laboratory tap. The sulphurous fumes are thus absorbed by water running to waste.

When the furnace has attained a temperature of about 1100 F, fumes will begin to evolve. The vacuum system, now switched on, removes the fumes and aids calcining of the sulphate. When a temperature of 2100 to 2200 F has been held for 2 hr, the furnace is shut off and allowed to cool slowly. The alumina is removed from the furnace, emptied onto a clean sheet of paper, rolled with a clean glass rod, and bottled.

If reactive metals such as zinc or zinc-base die castings are to be examined, one must be certain that no trace of sulphur is present in the calcined alumina. The test is: place a small quantity of alumina in a beaker (100 cc), add 50 cc of distilled water. Bring to a boil and simmer for 5 min. while constantly stirring. Allow to cool. Draw off supernatant liquid with a pipette and decant 25 cc into another beaker, to which is added 10 cc of barium chloride (10% solution) plus two or three drops of concentrated hydrochloric acid. Boil and cool. If this solution shows no sign of opalescence, or the presence of a fine precipitate, it is free of sulphur. If sulphur is still present, all of the powder is leached in distilled water, and again tested for purity with the above procedure.

POLISHING PROCEDURE

1. Make up a saturated solution of white beeswax (Cera Alb.) in clean white spirit. This is best used from a dropping bottle.

2. Commence polishing the specimen on 320-grit silicon-carbide paper, using a few drops of the above solution to wet the paper. Do not use the paper dry under any circumstances. Polishing scratches must run parallel to the edge which is being examined. Do not polish across this edge.

3. Clean the specimen with an old metallographic polishing cloth wetted with industrial spirit (rectified methylated spirit). When clean and dry, examine with a watchmakers' lens of about 3½ to 4 power. If the scratches are clean cut and superficial, the specimen is ready for the next paper.

4. Polish the cleaned specimen on 500-grit silicon-carbide paper, using the solution to keep the face of the specimen *wetted*. This will prevent deep scratching, a very necessary precaution when continuing the preparation process on fine papers. These papers, if allowed to dry, will rapidly clog with metal and molding powder. Then, there is every possibility of producing very deep abrasions on the surface of the specimen.

Keep the direction of the scratches *parallel* to the edge being prepared. Never turn the specimen through 90° when changing from one paper to another. After polishing about 1 min., clean as before and assess the degree of scratching. This should

now be very fine and shallow and much reduced in pitch.

5. Transfer the clean specimen to a 600-grit silicon-carbide paper, using copious wetting, and maintaining the scratches in the same direction. Polish for about 1 min., clean, and examine. The specimen should now be quite brilliant and the edge sharply defined.

6. Transfer to the final paper, viz. 000 emery. This is a difficult paper to define. Papers made in Britain, France, and the USA have been critically compared. The American papers are the only ones that produce a superlative surface. More damage can be done on 000 paper than one realizes, but, if it is well made, controlled polishing is secured, using the wetting solution described.

The scratches should now be visible only when using a glass. Continue polishing for about 3 to 4 min., using a very light but positive movement with unvarying pressure. The specimen should now have a mirror finish and the scratches very difficult to see . This is noticeable when preparing a two-phase alloy, such as 60-40 brass, when the alpha and beta phases will be seen to be of two distinct colors. Steel, aluminum alloys, nickel and its alloys, and even a dull metal such as solder, should reflect light like a mirror after this preparation.

The specimen is now ready for final polishing. Again it must be emphasized that on no account should the scratches be allowed to cross the vital edge that is the object of the examination.

METALLOGRAPHIC POLISHING

The specimen is finally polished on a clean, dust-free polishing cloth entirely by hand. This final polishing should not be prolonged.

The polishing cloth is cut into 10-in. squares and soaked in distilled water. Wetting aids retention of the minute alumina abrasive particles. Wring the cloth until just damp, then smooth it on a sheet of clean glass with the finger tips. Sprinkle a little distilled water over the center of the cloth and gently rub in the alumina, a little at a time, until the cloth is charged. No further addition of alumina will be needed. Gently rotate the specimen on the charged area of the cloth, moving it so that the action of the cutting is along the section. This improvement will prevent rounding the edge while the shallow scratches are being eliminated. Removal of scratches should take about 30 sec, and in no case more than 1 min.

The specimen is cleaned with distilled water, followed by industrial spirit, and then gently dried by rotating it on a clean dry polishing cloth kept exclusively for this purpose. Examine the polished surface with a lens. If a deep scratch or two is present, resume gentle polishing with 000 paper until these abrasions are removed. This is essential because continued polishing on cloth will tend to round the vital edge.

Having cleared the specimen of visible scratches, it must be metallography polished, because the registry of these abrasions will be seen at high magnifications. So, gently continue rotary movement on the alumina, using copious wetting with distilled water. The specimen should be fully polished in about 8 min., and after cleaning it is ready for microscopical examination.

A word concerning the storing of metallographic polishing cloths: these must be dust free. Dry cloths are best kept in cellophane envelopes in a desiccator, while abrasive ones are kept in a covered beaker filled with distilled water. The cloths are expensive but with care can last a long time. They are useless if allowed to soil. Washing may restore them, but a washed cloth never polishes so well as one that has its original nap unimpaired. These remarks also apply to papers, because these need just as careful storage as the cloths.

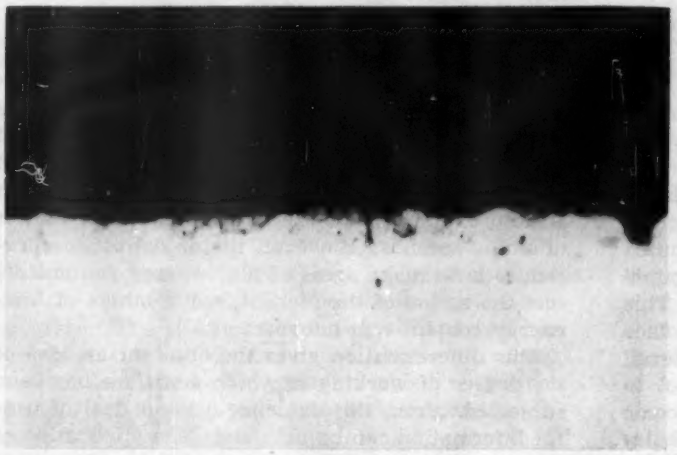
TECHNIQUE OF SURFACE EXAMINATION

Examination of surfaces is not easy, because the field available to the observer is limited. It is confined to a minutely shallow zone, which comprises the true surface and that of the subsurface linkage with the normal crystalline structure of the bulk metal. This depth of field rarely will exceed 0.001 in., and will most likely be about of 0.0001 in. Such a shallow depth contains all the reasons for the adaptability of a surface to a specific use, or for its unsuitability for this purpose. A general survey of such a section requires 1000 magnifications, while resolution of defects will require 2000 or more.

Do not be misled by the thought that such minute depths of metal are too insignificant to cause trouble. When one considers an electrodeposition, for example, the actual zone of real adhesion is only of atomic dimensions. The interface seen in the field of observation may be 0.00001 in. thick, but this includes the actual joining or linkage of the plating, and the much deeper layer of lattice adjustment which must take place when two dissimilar metals are bonded in this manner. By studying such conditions as those found in the watchband case, one can discriminate between a well-adhering deposit and one that will prove to be unreliable in service.

Metallographic investigation becomes particularly useful when assessing the "type" of surface produced in a production finish, and whether it will stand up to the many and varied conditions that prevail. Hence, when a surface is being examined, the observer must note every condition present. Then he pieces together all data so obtained and ventures an opinion of the value of a finish or what should be done in production to improve the surface finish.

Every form of finish leaves its "hall-mark." By recognizing conditions in evidence, it is possible to find out how such a surface was produced, and at what stage unwanted features were incorporated. For example, for a machined surface, cutting-tool efficiency can be assessed from the state of the sur-



"Uniform energy surface plates well"

FIG 7—Intermittent nickel deposit on 70-30 brass, time one to two seconds, is caused by failure to plate on work-hardened areas. Length of surface, 0.0013 in. Magnification, 3000 X

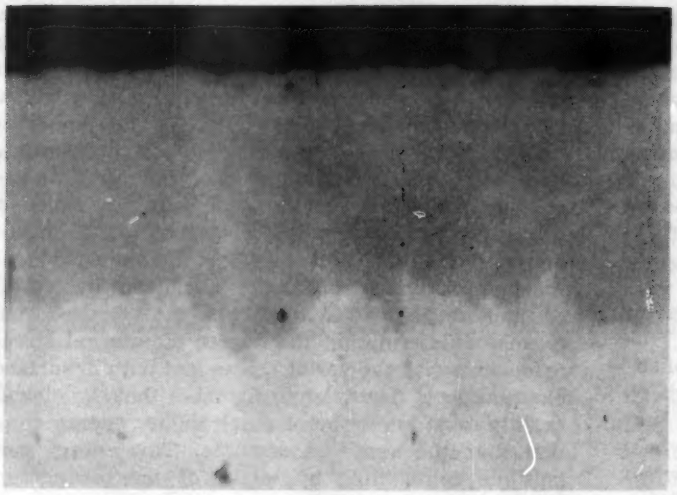


FIG 8—Undulations at the interface *A* are caused by selective action of the etchant on the high-energy work-hardened areas. Nickel deposit *B* is, however, continuous and smooth

face layer. The conditions necessary to promote excellent finishes at optimum metal-removal rates are well understood, but much surface-research work must be done before the exact formulation of cutting fluids can be worked out.

A further case is that of increasing machinability of metals while maintaining their quality. Sulfur and lead are used in steels to produce free-cutting properties, but the mechanism of such effects is not yet fully understood. When such information is available, the production of high-machinability steels and non-ferrous metals will be greatly advanced. Thus, the technique of surface examination incorporates observation of the structure of many types of mechanical finishes. By recognizing the various conditions which favor prolonged service life, one can diagnose faults constructively and suggest ways of attaining surfaces which have a good visual appearance and excellent properties.

The obvious question is: "How does one recognize good and bad properties from observation of surface structure"? In order to make this perfectly clear, it is necessary to give a brief account of what happens when a metal is machined, rolled, drawn, or polished. First, every metal consists of an aggregate of crystals that possess crystal symmetry internally, but lack such symmetry when considered from external appearance. An etched section of a metal will exhibit an aggregation of "grains," in some cases equiaxed, while others are elongated and appear striated, depending upon the degree of work imposed during manufacture. The main point one has to understand is that, if a crystalline aggregate is worked so that its internal atomic relationship becomes disturbed in a permanent manner, then its properties are completely altered. Such a deformation causes the crystals in the immediate vicinity of the application of a force to gain energy, and thus alters the properties of the original groupings.

To illustrate how this can be observed, controlled experiments were conducted on 0.35% carbon steel. The piece was carefully cut from a bar material and all evidence of machining removed by polishing on a series of abrasive papers. The whole piece was then etched to produce a completely undistorted surface throughout, and was then placed in a silica tube, sealed, and then annealed for 300 hr. Such a long anneal, in the absence of reacting atmosphere,

should restore all crystals to a state of practically minimum energy, and thus become completely unstrained.

A metallographic specimen is prepared and placed on the microscope stage. A small amount of slightly reactive immersion oil is placed on the specimen surface. This oil is prepared by adding a couple of drops of 0.1% nitric acid-alcohol solution. This slightly reactive oil will not injure the metal face of the immersion-lens housing, but stop-off material can be painted onto the metal, taking care not to touch the lens itself. No grain structure will become visible for a long time. Then, very slowly, the hairlines of the grain boundaries will develop. A fairly clear grain formation will be seen in about 2 hr. This slow etching procedure becomes a "yard-stick," whereby other conditions may be assessed.

Because a very weak reagent takes a certain length of time to delineate grain boundaries, which are of a higher energy content than the grain material itself, one has a measure of the energy content of similar crystalline aggregates after these have been worked. The action of the etch is speeded by energy contributed by the worked structure. Thus, a coldworked surface is delineated long before grain boundaries are revealed.

POLISHING CAUSED THE SURFACE TO FLOW

In the case of the fully annealed specimen, polishing was done by means of a power-driven wheel. This caused flow to take place on the extreme surface itself; that is, the action of the polishing wheel primarily produced "slip," just as would occur when any crystalline body is subjected to tension or shear. Continued polishing action raised the surface temperature. Thus, energy was added. Normal crystal slip was replaced by plastic movement; the surface material began to flow. This action broke up the crystal structure into minute fragments, each a geometrical replica of its parent crystal. With increasing heat absorption at the surface, the atoms began to lose their true groupings, and in flowing because of the polishing action these minute portions or crystallites were compacted into a layer-like structure. Evidence of stratification should be seen.

A cooled specimen was cut, polished with papers, metallographically polished and inspected at intervals after applying reactive oil. The microscope revealed the flowed surface section and its stratified condition, Fig 5, with evidence of bridging and interstitial spacing due to the combined action of the rotary wheel and the "to and fro" motion by hand. The etch revealed this high-energy flowed section in 20 min., but did not bring out any grain formation. This test shows how localized the effect of polishing really is, because the line of demarcation between each state is sharply defined, and no transition zone is evidenced.

This form of etching appears to be the only one that will reveal the true surface and sub-surface structure without masking all features likely to be present. Normal etching, such as the application of 1% nital, or a usual concentration of picric acid solution in alcohol, completely blots out any surface structure, and reveals the bulk metal in the matter of a few seconds. However, the object of this procedure is to make areas of high-energy content direct the action of the etchant, while others of low-energy content will not react at all.

This differentiation gives the observer an idea of the degree of working to which a surface has been subjected. From this evidence a great deal of useful information can be obtained. The application of this principle will define what has been responsible for an unsatisfactory surface, and also show the type of structure that constitutes a satisfactory type. Such procedures become invaluable when investigating the problems associated with "wear and tear," and those in which the efficient use of lubricants are being investigated.

One aspect of the techinque of surface examination, therefore, amounts to carrying out an extremely controlled etching procedure, in which a proved weak concentration of reagent will delineate known structure in a given time. The annealed steel specimen is a "control" that is significant by reason of the absence of locked-up stresses. It is used as a means of determining the degree of internal stress associated with the various cases met with in surface examination. Thus, any material that is etched rapidly must *per se* be of much higher energy content than the annealed example. This energy can only be contributed by virtue of the manner in which the metal has been worked.

According to this reasoning, a cold-drawn wire would behave totally different when etched than one which is fully annealed. In fact, the author has encountered cold-drawn wires whose surfaces were so highly energized that the flowed layer had become completely divorced from the core metal beneath. In reality, the surface was only a shell of flowed material surrounding a crystalline internal wire.

Etchants can be varied to suit the metal being investigated. The *"Handbook of Metals"* published by the American Society for Metals cites a complete range of reagents applicable to all metals used in industry. From these formulas a series of weak, but effective, surface reagents can be evolved, using the form of procedure described briefly above. The method can be used quantitatively as well as in a qualitative manner. By commencing with an annealed metal, known amounts of work can be imposed, and the behavior of the surface followed by a series of examinations at each stage.

TECHNIQUE OF HIGH-MAGNIFICATION PHOTOMICROGRAPHY

It is not easy to obtain absolutely sharp and clear images when photographing surface structures at very high magnifications. The slightest touch on the

fine adjustment of a microscope will decide between clear delineation of a structure and one that appears "hazy." To overcome this difficulty, a new type of focusing screen was devised. This screen is indispensable at magnifications of 2000 and 3000 times.

The screen is made by flashing a panchromatic plate to produce partial fogging. This is important, and the shortest possible exposure to light should be given. The plate is developed until it is of an even intensity but not too dense, and is then fixed, washed, and dried. The plate is wiped with clean cotton wool impregnated with metallographic alumina. The procedure is: wipe along the length of the emulsion side of the plate to produce a very light scoring of the film, which will be entirely superficial and difficult to discern: then, repeat across the plate, and so produce a "grill" of exceedingly fine dimensions.

The plate can be ruled diagonally, using a fine mapping pen. This serves to locate central objects and so assists in obtaining a balanced type of negative. The plate, on completion of this operation, is mounted in the place of the usual frosted screen supplied for focussing, with its emulsion side innermost, *i.e.* the plain glass side is facing outwards.

The object being examined is brought to a sharp visual focus and is then projected onto the emulsion screen, but will not be visible until scanned with a watchmaker's lens (about 3½ power) laid flat onto the glass side of the screen. A clear image will be seen and can be focussed absolutely sharp.

The emulsion of the photographic plate will occupy the identical level that the emulsion of the screen occupied during adjustment of the sharp focus. Hence, a very clear image will be obtained, and the resulting negative will be exceedingly clear and detailed.

There are many points to watch when producing photomicrographs. Dust is one of the worst enemies encountered in microscopy, and in view of this the mechanical slides, coarse, and fine adjustments must be frequently cleaned and given the merest touch of finest clock oil. The instrument must be as "firm as a rock." Check this on the emulsion screen by bringing an object into perfect focus, leave the instrument set for about 15 min., and recheck.

Production and research problems

The resolving power of the best microscopes available today is limited for surface investigation. The true surface—the actual boundary of a solid which forms the air-solid interface itself—is so shallow that it is extremely difficult to obtain real information about its actual constitution and how this contributes to its behavior. Nevertheless, such behavior can be deduced by piecing together observed facts to build up a logical case that can be proved later.

The true surface itself, if one accepts the modern definition, is only from 1 to 2 x 10^{-7} cms. Electron diffraction provides a guide as to the constitution of this minute layer. Experimentation, employing different forms of surface finish on various types of solids, will prove informative. It will be learned that behavior of a surface is a function of how it is produced, and that operations long before final finishing contribute their influence. However, electron diffraction is severely handicapped by micro-contamination, either in the guise of very thin oxide or sulphide films, or mono-molecular layers of grease. In consequence, true surface conditions can only be ascertained from what is present in the sub-surface layers. The microscope can deal with these.

One thus observes the "apparent" surface, knowing that the "true" surface will be the determinant as to any defect, or absence of unwanted features, found by careful scrutiny. This case is somewhat analogous to that of a physicist studying ionization phenomena in a Wilson's cloud chamber—the trail of vapor is seen and the speed of its generation noted, together with its curvature in the presence of a high magnetic field. The physicist does not observe the ion itself, but providing he has the facts of its speed and the radius of curvature of its path, he can calculate the size of the particle. The metallographer is similarly situated, he can observe the influence of the surface, and thus is able to deduce the kind of surface which would produce the effects noted.

To illustrate the method, consider a few typical examples: First, make a careful survey of a specimen by means of a low-power lens. For a case of fatigue, failure, one can trace evidence that will point out the origin of the defect.. So far, this is useful, but not concrete evidence. Examine surface sections which are suspect at the supposed origin, and others in the immediate vicinity. Suppose the interpretation is that failure is due to the type of surface finish. If so, a series of micro stress raisers will be found, together with fields of subsidiary fatigue cracking. These can be revealed only by use of the dilute etchant described. The metal in the vicinity of the real cause of failure will show evidence of distress in the form of faint hair lines flowing from the possible stress concentration zones in the surface, while faint tortuous cracking will be observed at or just below the surface itself. These usually commence at a normal to the surface, and then branch off into tributary fields of breakdown. Such cracks are sometimes only 0.0005 in. in length, but are significant because they lie adjacent to the main stress raising zone.

The author has examined steel components which

have revealed 40 such hair cracks, each individual and not in any way linked, in a distance of ⅜ in. along a suspected section of a surface which had been racked by alternating stresses. These hair cracks indicated the presence of micro-pits or micro-notches, close together. The surface stresses concentrated on each in turn, or resonated along the zone, until one stress center yielded more than the others, creating the principal and rapid propagation of failure.

In the case of fatigue specimens given a *superlative visual appearance* by electropolishing, the author has examined dozens of unbroken ones. After testing at a given number of reversals of stress (at the critical fatigue loading), micro-cracking was found over a distance of ⅝ in. along the surface. Each of these minute cracks could have responded to the effect of the stress, and thus rapidly yielded causing almost instantaneous failure. Normal etching would blot out every indication of hair-line cracking or stress effect. By using the method described previously, however, valuable information becomes available. If not so obtained, its lack may cause a misinterpretation of how failure came about, and may lead to a repetition of the defect in future designs.

TURBINE-BLADE FAILURE

Before leaving the subject of fatigue, let's describe a failure of an obscure nature, but one that might be met with in high-speed engines. A series of gas-turbine-blade failures exhibited the unmistakable conchoidal form of fracture associated with fatigue. Blade surfaces were mirror like. Nevertheless, each had failed in fatigue. A metallographic specimen was prepared from a surface section adjacent to the edge of fracture. By oil immersion etching, the reason for failure became obvious. Blade contour was generated by a pantographic process, which left the surface in a serrated condition. Subsequent polishing operations blended the rough finish and so produced a smooth contour suitable to cope with gas flow. Unfortunately, the polishing process had only flowed the crests of the serrations into the troughs, and only a "psuedo-surface," or shell covering, had been produced. The original serrations, or at least their main registry, were still present and actually constituted the true surface integral with the bulk metal. This, then, was the surface which had to resist fatigue stresses. Each registry acted as a stress raiser and failure occurred in a few hours of running. Thus, it may be seen that an excellent finish, which has not been systematically planned and executed, can be deceptive. Here, again, normal etching would have obscured most of the real evidence, and the remedy could have been long delayed.

Surface preparation for electrode positioning or establishment of chemical films can be assisted by use of surface metallography. The actual inception of an electrodeposit in its first few seconds is not wholly understood. It has become increasingly apparent that the state of the surface is a major factor in producing a good or an indifferent type of plating. Good practice is to subject a surface to one, two, three or more seconds of plating and then examining each sample in section. From the mode of actual real surface deposition at each interval of time, the suitability of a surface for the particular purpose can be assessed. From the findings a type of surface can be produced that will give continuous plating throughout the entire area.

To illustrate the method, consider two different surfaces *on* the same sample—a 70-30 brass sheet used to fabricate auto parts. Parts were formed in press tools, polished and given a heavy nickel plate, followed by decorative chromium plate. In every case, the surface appearance of the deposition was rough, adhesion was insufficient. Solutions, current densities, temperatures, and surface cleanliness were checked but no improvement could be made. Then, a test was carried out to determine whether the surface was the reason for indifferent results.

A sample was plated for one to two seconds, withdrawn, washed, dried, and sectioned. Portions of the surface were covered by the nickel, while others were completely free. Obviously, uncovered portions were in a state not conducive to formation of surface additives. This effect could be brought about by the manner in which the original sheet was rolled and aggravated by ironing or extreme cold working during manufacturing. At any rate, something produced a hardened surface structure. Such a surface is difficult to define. Portions of it are extremely cold worked and consequently of high energy content; others are relatively soft. Hence it is possible to find areas where deposition is easily effected, while others reject plating. It is obvious that such a surface will foster selective deposition and hence produce a contour which is far from plane and will exhibit "roughness." The amenable sections will encourage growth of the deposit, while the others will only be covered by a shell of plate linked to the adherent parts by bridging, which must result in poor adhesion.

ETCHING OVERCOMES POOR PLATING

The obvious remedy in this case is to treat the surface so that the zones where deposition is absent are converted into a condition obtaining on the amenable areas. This can be brought about by using a gentle etch, which will react with the former and make little or no alteration to the latter. Such an etch consists of 20 parts phosphoric acid, 10 parts of nitric acid, 5 parts of hydrochloric acid, and 1 part water. After mixing, 5 parts of normal butyl alcohol and 2 parts of a wetting agent are stirred in. This composition will amend a surface, however cold worked, in 10 min. to 2 hr.

The technique of producing a surface of "equal property value" could only have been evolved by high-magnification study of surfaces. The actual maximum depth of amendment or etching of any

Brownian particles spoiled plating

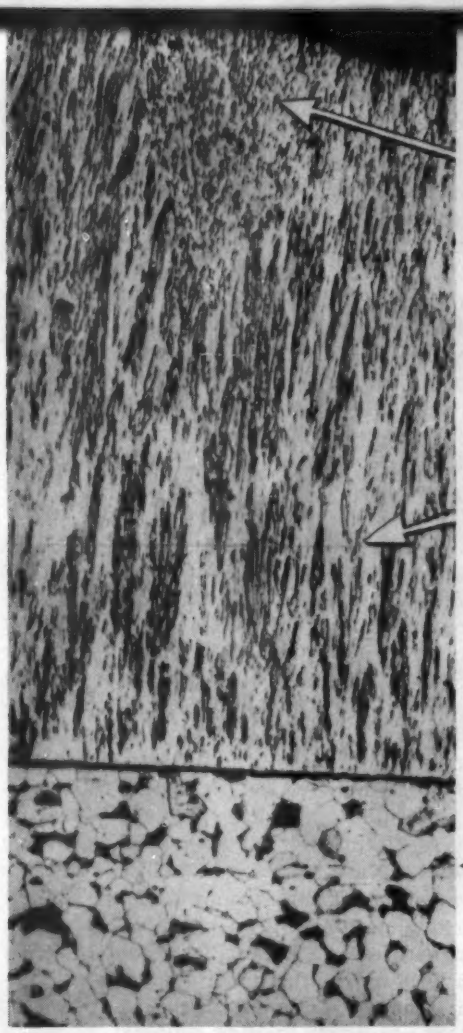


FIG 9—Heavy nickel deposit on steel piston rod was rough, and found to be porous by grinding. A dual section was selectively etched to reveal the structures of nickel and steel. At *A* is a conical-shaped deposit in the nickel, and at *B* one sees columnar crystals in the nickel. Structure of the steel is at *C*. Magnification, 400 X

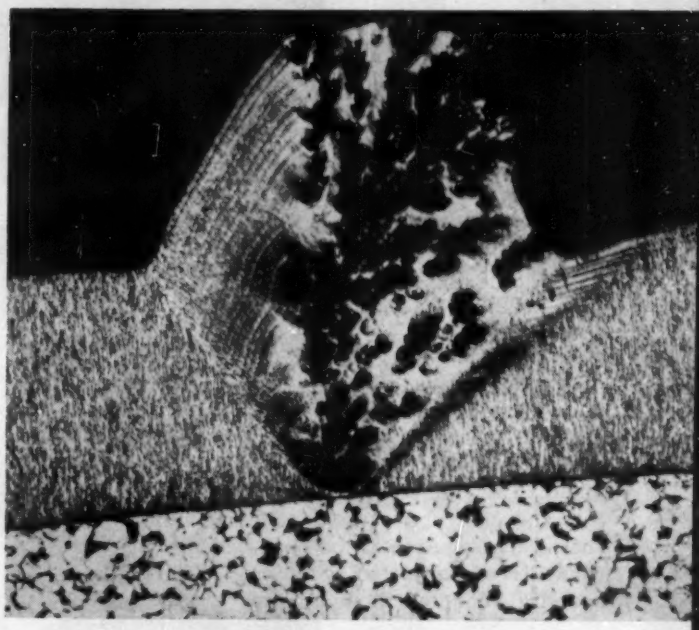


FIG 10—Fully developed nodule in the heavy nickel deposit was caused by extremely small particles in the plating solution. These particles were so small that they could be seen only with a pathological microscope. Magnification, 200 X

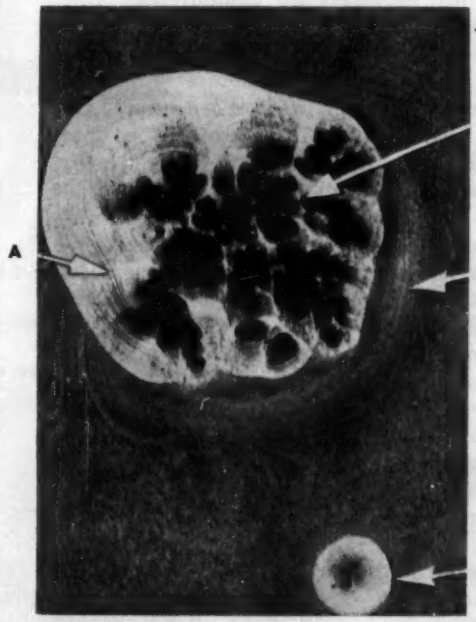


FIG 11—Plan or transverse section of the nodule. Laminar structure *A* was due to minute-particle interference. At *B* is the ground mass of columnar crystals. Honeycomb structure *C* consists of large pores. At *D* is the interference zone in mode of crystal growth, as shown by dark lines at right of nodule in Fig. 10. An embryo nodule is seen at *E*. Magnification, 200 X

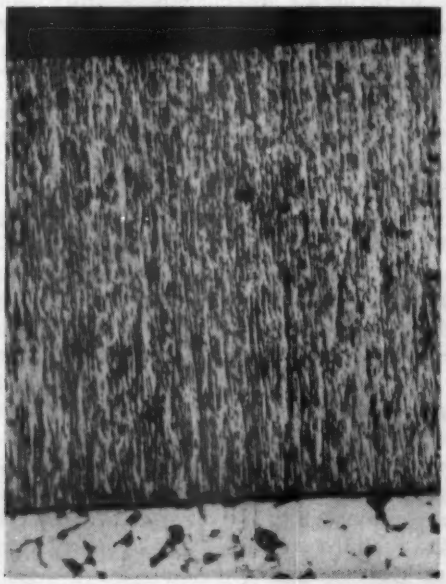


FIG 12—Filtration of the electrolyte with activated carbon removed the Brownian-size particles. The rectified plating solution then produced a fine-columnar heavy nickel deposit suitable for the end use of the product. Magnification, 400 X

part of the surface does not exceed 0.0002 in. This, of course, includes the degree of sub-surface distortion lying directly below the truly cold-worked area of the actual surface itself, and would be undetectable in a surface surveyed on a macro scale.

Another production-research problem concerns dissimilar metals, such as building up worn parts with heavy plating. An investigation was made of the extreme roughness and porosity of such a deposit on worn piston rods made of a 0.25% carbon steel containing 1% nickel. The nickel deposit was 0.010 in. thick. After grinding off 0.005 in. on the dia, the originally rough deposit was found to be extremely porous. Purpose of the nickel was to produce a surface that would not corrode in the presence of water and olive oil, and would give a very smooth surface to work through a fiber-packed gland. The slightest serration in the surface would tear the fiber and cause air leakage. Hence, these rods were required to be like mirrors. The rough condition of the plated rods, accompanied by severe porosity, rendered them useless.

A DUAL-MATERIAL SECTION REQUIRED

Here, we must know the structure both of the nickel and of the steel base. Nothing is learned if the nickel is removed and the steel examined, or vice versa. Hence, the two continuous structures in a dual section are necessary for examination. One metal is much harder than the other producing a differential level at polishing, and the etchant which attacks nickel and reveals its structure will completely blot out the steel structure due to the rapid attack. Thus, it will be impossible to focus, so that the complete field comprising both the nickel layer and the steel rod lie absolutely level.

The method of polishing such a section is identical with that described previously, and success depends entirely on the removal of all superficial scratches in 30 sec. of careful hand polishing. This entails controlled paper preparation prior to final polishing. A comparatively low magnification, 400 X, reveals all conditions present in a case like this. It is only necessary to resort to very high magnifications in order to observe the effect of a type of surface, or to detect signs that allow of a correct interpretation of conditions encountered and which need explanation. The 0.01 in. deposit of nickel is not particularly level, Fig. 9, while the steel shows a typical unheat-treated structure, consisting of fine grains of pearlite and ferrite. The depth of steel shown is around 0.006 in., which is ample to check the structure in the vicinity of the rod surface.

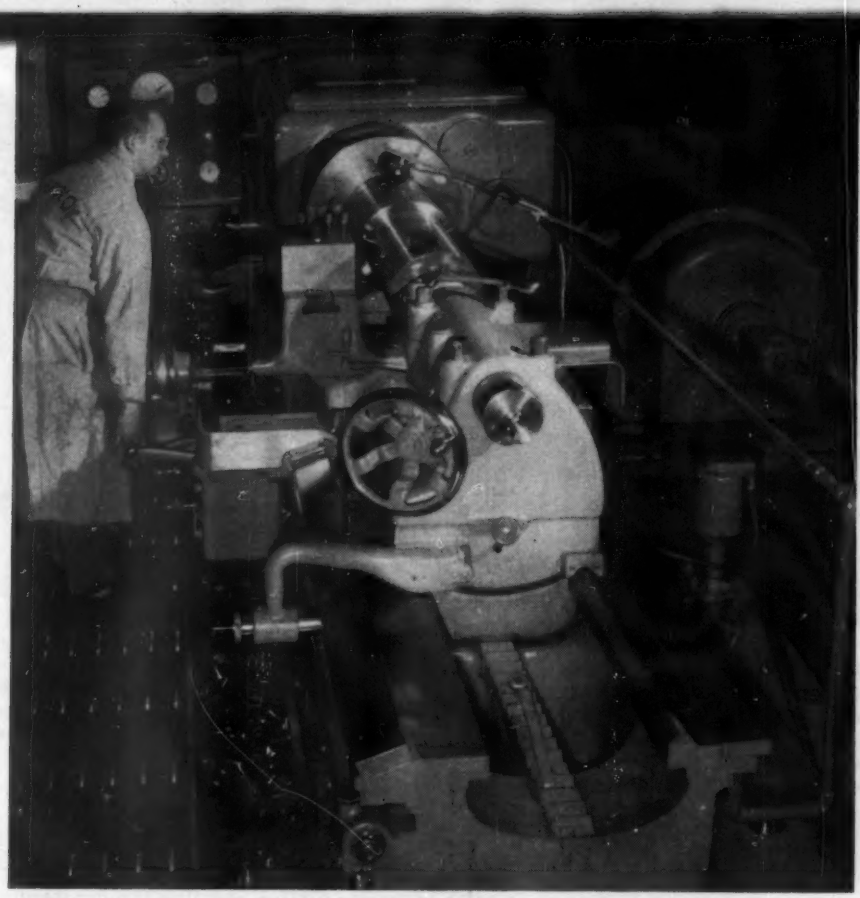
Most metallographers can produce a level section consisting of two distinct metals, but may encounter difficulties when etching them. The procedure in this case was:

The nickel, which is fairly resistant to etching is dealt with first. An etchant is prepared that lightly attacks the nickel, but passivates the steel, and thus produces no attack on the ferrous metal. Such an etch can be made of 40 parts of clear nitric acid (1.42 Bé) and 10 parts of glacial acetic acid. Using platinum-plated tongs, immerse the specimen in the etch for about 15 sec., rapidly wash in alcohol, then plunge into a second alcohol rinse. Dry the specimen by careful rotary movements on clean polishing cloth. Next, place the specimen in a solution of 0.5% nital for 30 sec to develop the steel structure, rinse with clean alcohol and dry. The specimen will be found to be perfectly etched and quite level throughout the steel and nickel sections. A series of three photomicrographs shows the state of affairs. The steel is faultless and the inception of the heavy nickel plate is all that can be desired, but the normal mode of growth of the deposit has completely altered due to some extraneous influence while deposition was being effected. The section of plating and base metal as shown in Figs 9 and 10, reveal the presence of a foreign growth with accompanying cavities in its vicinity, while Fig 11 shows a transverse section through the growth itself.

At this stage, examine the structure of a correctly constituted nickel deposit, Fig 12. Here, the deposit is cleanly built up in the form of elongated tapering grains, that is, columnar structure, and the surface is plane. A comparison of the two cases indicates that there must have been a potent influence present to transform a normally growing plate into such fantastic structures as seen in Figs 9 and 10. This was due entirely to interference in the mode of crystal growth. The only manner this can be accomplished is by additives, such as colloidal particles, which cover parts of the surface and mask the actual building up of the crystals in their vicinity.

UNUSUAL CONTAMINATION IN ELECTROLYTE

A sample of the bath solution was taken and checked on a pathological microscope. Exceedingly small insoluble particles were found in large numbers. These were of the dimensions of Brownian particles, because the movements could be clearly observed and a count estimated. A certain amount of particles must always be suspended in an industrial electrolyte by reason of dust-laden atmospheres, but when the population exceeds a critical value, their presence is manifested by an effect such as that described. Filtering by usual methods will not eliminate them. They can only be removed by means of activated carbon, which adsorbs them on its surface and so rids the solution of this trouble. These minute particles carry a charge or number of charges, which orients them to one side of the growths occasioned by their presence, as will be seen in the plan view (i.e the transverse section) of Fig 11. The solution in question was treated with activated carbon and allowed to stand for 48 hr, after which it was filtered and checked by microscopy. The count of particles was very small and so plating was resumed. Fig 12 was obtained from a sample of the rectified solution. It is apparent that the fault has been overcome.



HIGH-POWERED MACHINES are the current trend to make best use of carbides on hard-to-machine metals and to increase production rates. Tool cost should be considered a secondary factor in operating them at maximum efficiency — low cost and results count

How to cut costs with carbides by "Hi-E" machining

T E HAYES, service engineer
Carboloy Department, GENERAL ELECTRIC COMPANY

Current trend toward cutting more and more "hard-to-machine" metals in less time makes increased efficiency mandatory. As much as 50% of the savings normally gained with carbide tools are often lost by poor machining methods. Here's a simple method of correlating all factors to achieve optimum efficiency

In the light of current high labor and equipment costs, carbide tools are cheap compared with man-hours. To operate profitably then, carbide users must realize that trading tool costs for less equipment and fewer man-hours on an operation is a real bargain in terms of reduced production costs. It is highly impractical to spend $25,000 to $90,000 for a machine developed to utilize carbides to best advantage, then to try to hold tool costs down to $25. Tool cost should not be the prime factor in setting up a job—rather, most-efficient machining methods should be the first consideration.

High-efficiency (or "Hi-E") machining combines a number of factors to provide a range of cutting speeds for a given job to obtain lowest cost per piece machined, best tool life, and reduced floor-to-floor time. Graphically it can be represented by an area on a chart between the lowest points on a total-*cost*-per-piece curve and a total-*time*-per-piece curve. The Hi-E area then shows optimum speeds to obtain minimum cost and time per piece.

DEVELOPING A HI-E CHART

To chart the Hi-E area, it is first necessary, of course, to develop time-per-piece and cost-per-piece curves. The latter is made up of three components; machining cost, tool cost per cutting edge, and non-productive costs. These factors are obtained thus:

$$\text{MACHINING COST} = \text{machining time} \times (\text{labor} + \text{overhead})$$

$$\text{Machining time} = \frac{\text{Length of piece}}{\text{Feed} \times \text{rpm}}$$

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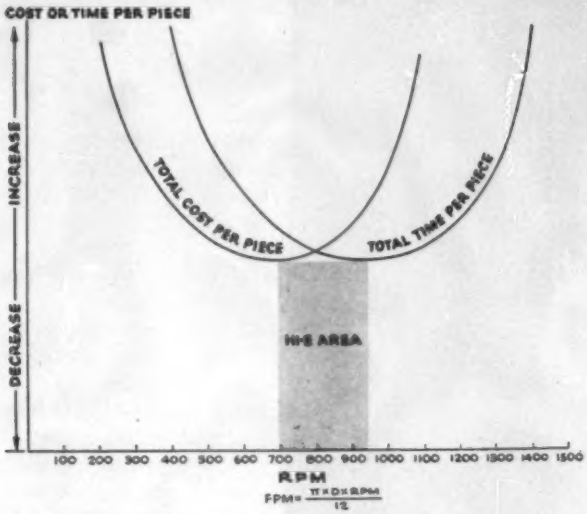
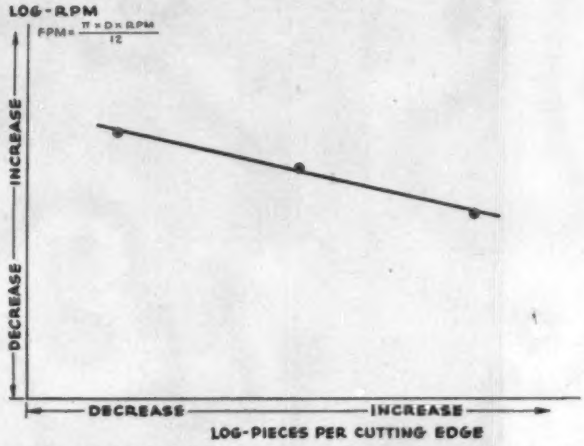

COST OR TIME PER PIECE
INCREASE
DECREASE
TOTAL COST PER PIECE
TOTAL TIME PER PIECE
HI-E AREA
100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500
RPM
FPM= π × D × RPM / 12

BEST SPEEDS to obtain lowest costs and least machining time are in the Hi-E area. This is represented graphically between two minimum points on a total-cost-per-piece curve and a total-time-per-piece curve. With this chart, optimum speeds for each successive operation are quickly and easily found when a number of operations are performed on the same material



REASONABLE ACCURACY in charting data is obtained by running several tests. In this log-log graph for plotting number of pieces per cutting edge, a machine is run at maximum, medium and minimum speeds and the number of pieces obtained per edge counted and charted at each speed. Pieces per cutting edge at a given speed is a factor in developing the total-machining-cost-per-piece curve

$$\text{TOOL COST/PIECE} = \frac{\text{Tool chg cost} + \text{tool grd cost/edge} + \text{tool depreciation/edge}}{\text{Pieces per edge}}$$

Where:

Tool changing cost =
tool chg time × (operator's rate + overhead)

Tool grd cost per edge =

$$\frac{\text{grinding time} \times (\text{grinder's rate} + \text{overhead})}{\text{Number of cutting edges}}$$

Tool depreciation cost per edge =

$$\frac{\text{Cost of tool}}{\text{No. of grinds} \times \text{No. of cutting edges}}$$

(Six to eight regrinds on a brazed tool are usually normal.)

Total machining cost can be obtained by totalling the tool-changing, tool-grinding, and tool-depreciating costs, then dividing by the number of pieces per edge at a given rpm. The latter factor—number of pieces per cutting edge at a given rpm—can be obtained directly from the job by operating the machine at a maximum rpm, a medium speed and then a minimum speed—then counting the number of pieces received per edge.

Several tests are recommended to obtain greater reliability in the results. Reasonable accuracy may be achieved if the data are plotted in a log-log graph, and a straight line drawn between the three points obtained at the three different speeds. If the data are fairly accurate, the three points will line up with only slight variation. To plot machining-cost and tool-cost curves, the machining time can be calculated for several speeds by substituting rpm in the machining-cost equation containing the piece length, then dividing by the feed times the rpm. Tool cost can be obtained by taking a summation of the tool-changing, tool-grinding and tool-depreciation costs, then dividing the total by the number of pieces per cutting edge.

The non-productive cost line is a constant and can be found by: *NONPRODUCTIVE COST* = Loading, noncutting, traverse time, etc × (labor + overhead).

If these costs (machining, tool and nonproductive costs) are plotted on a graph, the lines can be summed by adding the vertical distances with a set of dividers at several rpms, then plotting the summation of the total heights to arrive at the total-cost-per-piece curve.

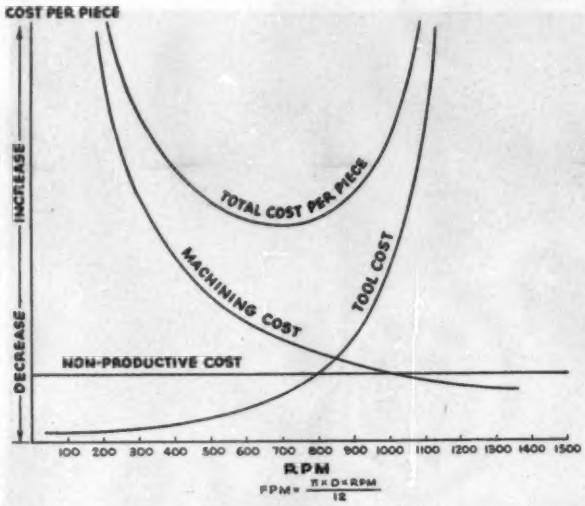
A similar approach can be taken in arriving at the total time required to produce one piece. A curve for machining time per piece can be plotted by dividing the length of the piece by the feed times the rpm at several speeds. Tool-changing time per piece is established by dividing the time to change one tool by the number of pieces per cutting edge for several speeds.

Nonproductive time can be found by simply determining the amount of time to load and unload the piece in the machine, the time required to get the tool into the cut, and other non-cutting time for each piece. Totaling the vertical heights of these lines produces the total-time-per-piece curve.

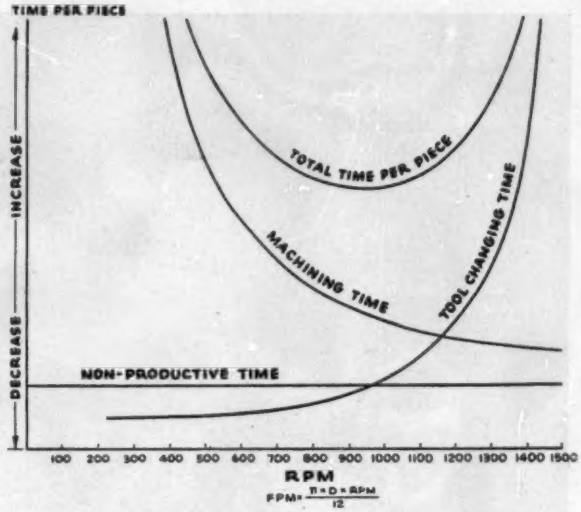
HOW TO USE HI-E

By comparing the minimum points on the total-cost-per-piece curve and the total-time-per-piece curve, the Hi-E area (optimum speeds for minimum costs and minimum time per piece) is determined. Speed chosen in this area will depend on several factors.

If cost is the only consideration, a speed within the area but as close to the left side as possible will give the most reasonable cost per piece. If machine investment is high, and there is some limitation of space available for production equipment, it may


COST PER PIECE
INCREASE
DECREASE
TOTAL COST PER PIECE
MACHINING COST
TOOL COST
NON-PRODUCTIVE COST
100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500
RPM
FPM = π × D × RPM / 12

TOTAL COST PER PIECE is plotted to produce a curve for the Hi-E area chart. Factors of the total cost per piece are machining cost, tool cost per cutting edge and non-productive costs. These are plotted first, then the sum of their vertical heights at different speeds plotted to determine the total-cost-per-piece curve


TIME PER PIECE
INCREASE
DECREASE
TOTAL TIME PER PIECE
MACHINING TIME
TOOL CHANGING TIME
NON-PRODUCTIVE TIME
100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500
RPM
FPM = π × D × RPM / 12

TOTAL TIME PER PIECE is based on machining time per piece, tool-changing time and such non-productive time as time to load, unload and move the tool into cutting contact. Plotting these factors on a chart and totalling the vertical heights of the resulting curves produces the total-time-per-piece curve used in the Hi-E chart

be more economical to run at a speed at the right side of the area, increasing the cost per piece somewhat, but getting production required with fewer machines, and at a minimum time per piece.

In a situation where hardened high-alloy steels, stainless steels, and other jet-engine alloys are being machined, production obtained at minimum cost per piece is so slow that production schedules will not be met unless more equipment is added. Under such conditions, it is often necessary to use speeds in the right side of the area up to the "minimum-time-per-piece" line.

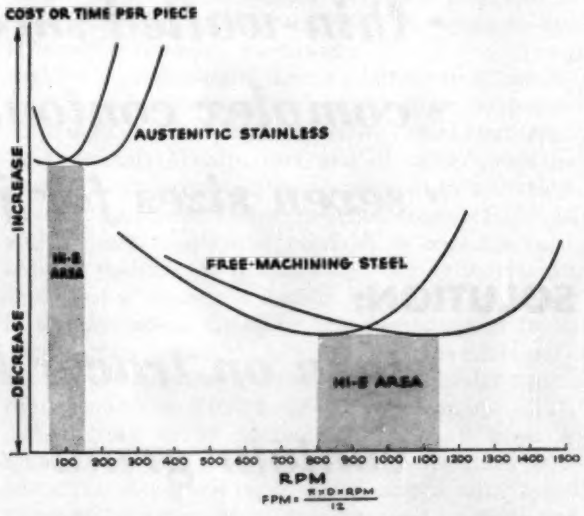
In automatic machines, all tools should be run at a speed above the minimum-cost-per-piece side of the Hi-E area. This means that some tools will be operating at substantially higher speeds, but every effort should be made to confine the range of speeds within the Hi-E area.

The use of improved carbide grades in areas where tools must be run above the minimum-cost-per-piece point to the speed required. In automatic machines where the increase in tool life obtained from the improved carbides will enable an increase in production of several hundred percent, these newer carbide grades are even more profitable.

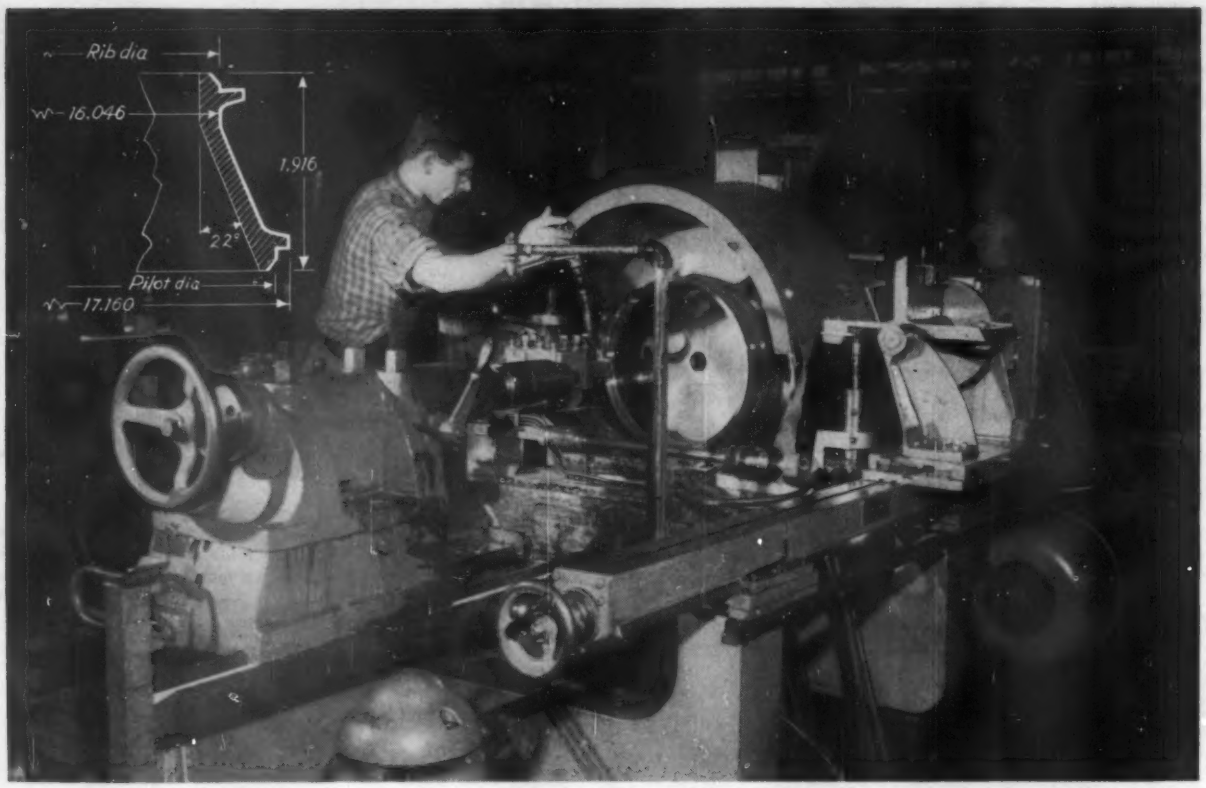
When situations warrant, speeds can be increased even more to obtain the maximum production rate available with this type of equipment. In some cases, optimum cutting speeds cannot be used because of a lack of available horsepower on the machine tools.

Development of adequately powered machine tools, which can fully utilize carbides, makes higher speed ranges currently available. These are also equipped to reduce nonproductive time with air and hydraulic chucks, faster holding devices and more accessible controls—all aids to reduced total machining costs.

Tool-changing time and regrinding costs in many cases also are reduced with mechanical holders for insert tools and throwaway carbide tips. All of these increase the advantages of operating in the Hi-E area, and enable users to take more complete advantage of the new carbide materials.


COST OR TIME PER PIECE
INCREASE
DECREASE
AUSTENITIC STAINLESS
HI-E AREA
FREE-MACHINING STEEL
HI-E AREA
100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500
RPM
FPM = π × D × RPM / 12

HI-E AREAS VARY with different materials. If a speed at the left of the Hi-E area for stainless steel is employed, tool cost would be low but production rates would probably be impractical. Moving to a speed at the right of this area increases tool cost but jumps production rates. Curves at the right of this chart show a Hi-E area for B-1112 steel and indicate that higher turning speeds can be used to great advantage for minimum cost per piece



Contour boring . . .
the ID of a forged cylinder is accomplished in a McDougall lathe equipped with a 2-cyl Turchan follower. A turret is indexed to engage one of three templets for internal contours. Internal and external templets are set up in relationship to each other to maintain critical wall-thickness dimensions. General contour is sketched at upper left

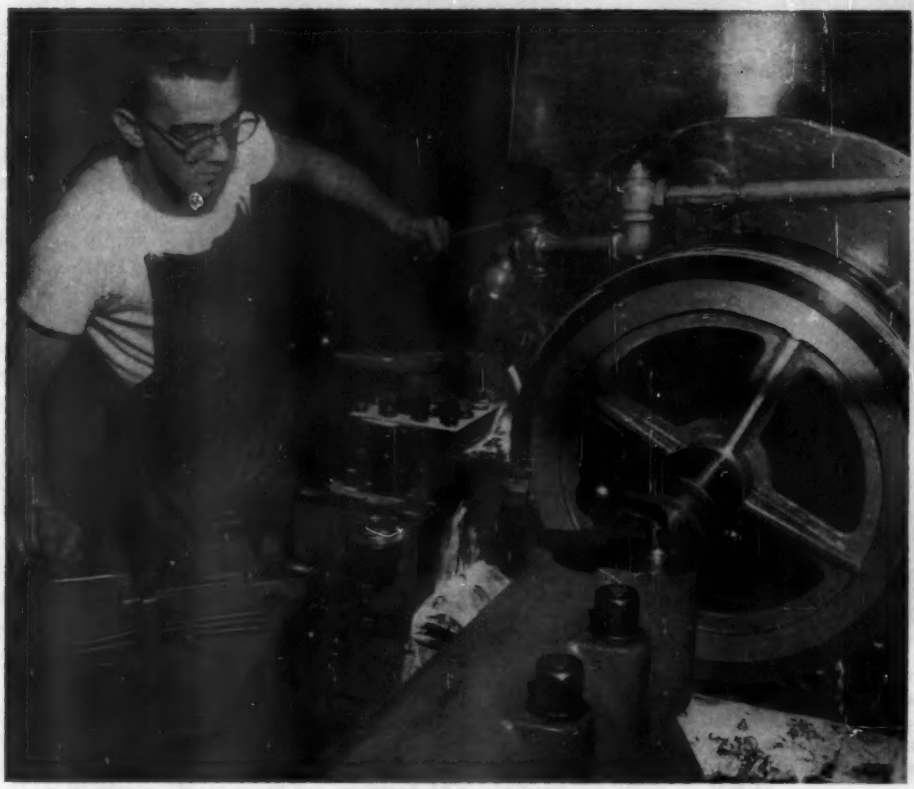
PROBLEM:

- ***thin-walled shroud rings***
- ***complex contours, tight tolerances***
- ***seven sizes for jet engines***

SOLUTION:

- ***turn on tracer lathes***
- ***contour grind***
- ***automatic wheel dressing, sizing***

HERE'S HOW OLDSMOBILE DID IT ▶



Special live center . . .
has internal contour of a shroud ring on its periphery —is engaged after internal contour is done and maintains relationship of inner and outer contours while outside contour is machined. Work is also located against a ground face to establish axial dimensions and overall length. The live center supports the part and holds it when it is cut off from the forged cylinder by a manual plunge cut

GEORGE De GROAT, associate editor

Thin walls, large diameters, and close tolerances combine to make jet-engine shroud-ring production a problem. At Oldsmobile Div, GMC, the problem has been solved by special equipment and careful processing. Shroud rings are made in seven different sizes from AMS 6412 forgings. A typical ring forging would be 20 in. OD by 8 in. long, with a mean ID of approximately 17½ in. Such forgings are normalized and drawn before the process is started, and shot blasting removes forging scale to lengthen tool life in initial operations.

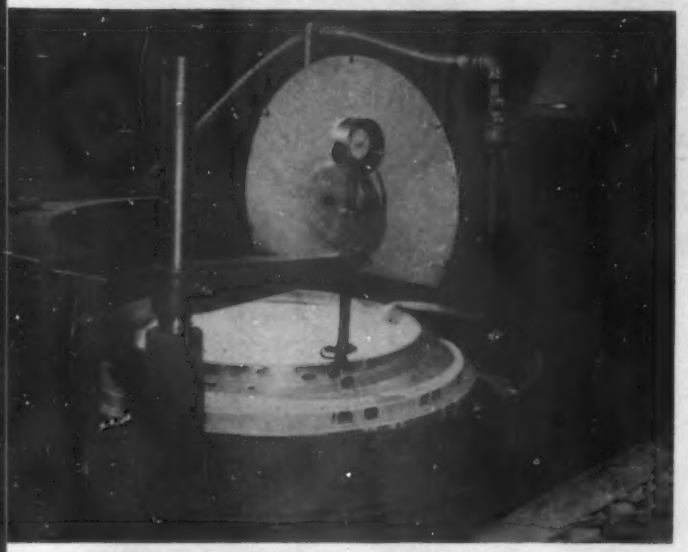
INITIAL OPERATIONS

First step in the process is to rough machine the forgings. Boye-Emmes engine lathes with four-position McCroskey turrets do facing, counterboring, chamfering, and forming a clamping groove which later holds the cylinder in other operations. The counterbore locates this groove, and facing establishes squareness with the bore. Carbide tools handle all machining.

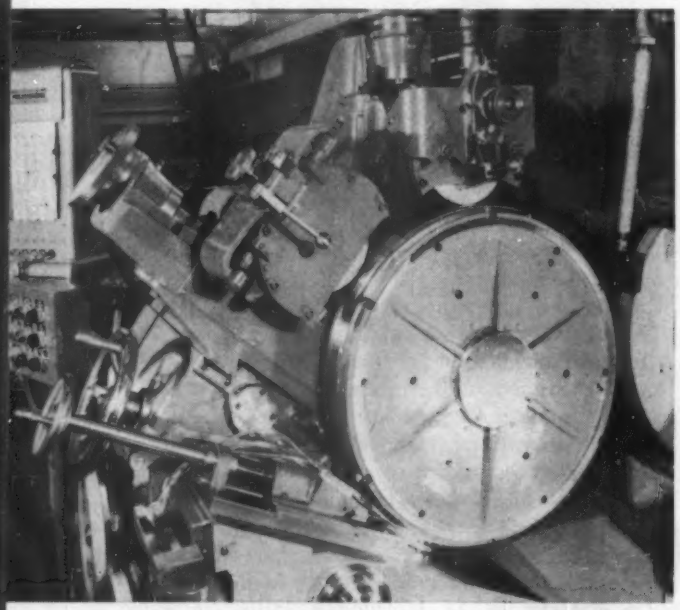
First contouring work that follows rough machining is done in McDougall lathes with 45 in. between centers but modified for a 31-½ in. swing to take all sizes of shroud rings. Here the angular contour or rise of 22½°, is produced inside and outside the forged cylinder in three places along the axis, one for each shroud ring to be made later. These lathes are equipped with single-cross-slide Turchan followers for rough-boring the internal contour. A toolblock with a boring bar is operated from a templet having the desired contour, while the rough turning and facing tools are manually operated against pre-adjusted positive stops. The face previously machined is located against a faceplate to which the work is clamped, while the opposite end is faced to establish parallelism.

Careful processing to insure accuracy in all operations includes washing the forgings after rough machining to prepare them for a stress-relief heat treat. This removes all chips, dirt, and oil, after which the rings are normalized and die-quenched in a Gleason hydraulic machine. Hardness at this stage is R_c 32-36 and a uniform shape is retained to expedite subsequent operations. If necessary, the cylinders are shot blasted again, but usually little scale is created in this operation. Grinding the clamping end for a locating face is another intermediate operation, performed in a Blanchard vertical surface grinder which removes 0.005 to 0.035 in. of stock to clean up.

A battery of 12 McDougall lathes, 8 Boye & Emmes, and one Lehmann contour-machines ID's and OD's. All three types are equipped with 2-cyl Turchan followers. Here, the open end opposite the ground clamping end is finish faced, the bore is finished and polished, and all internal sharp edges are broken. A 4-position templet turret at the rear of a lathe carries three templets. First templet is for ID contours, the second for facing, the third for OD contours. A special live center held in the tailstock



Over-all length . . .
within plus or minus 0.001 in. is maintained by surface grinding the cut-off face after machining contours. Dial-indicator fixture permits close check while approximately 0.010 in. is ground off. Great care is required in locating and clamping the work because of thin walls—around ⅝ in.



Crush-form grinding . . .
external contours is performed in a special machine with three wheels. Work is held on a segmented expanding air fixture, bearing against a ground face to maintain axial dimensions. The large wheel, right, produces an angular form in the center of the ring, while two smaller wheels form-grind contours on either side of the center contour. Feed-back control to compensate for wheel wear, automatic size indication on the Precisionaire fixture, and automatic wheel dressing combine to simplify a difficult operaton. Oil coolant is reclaimed by means of a magnetic separator

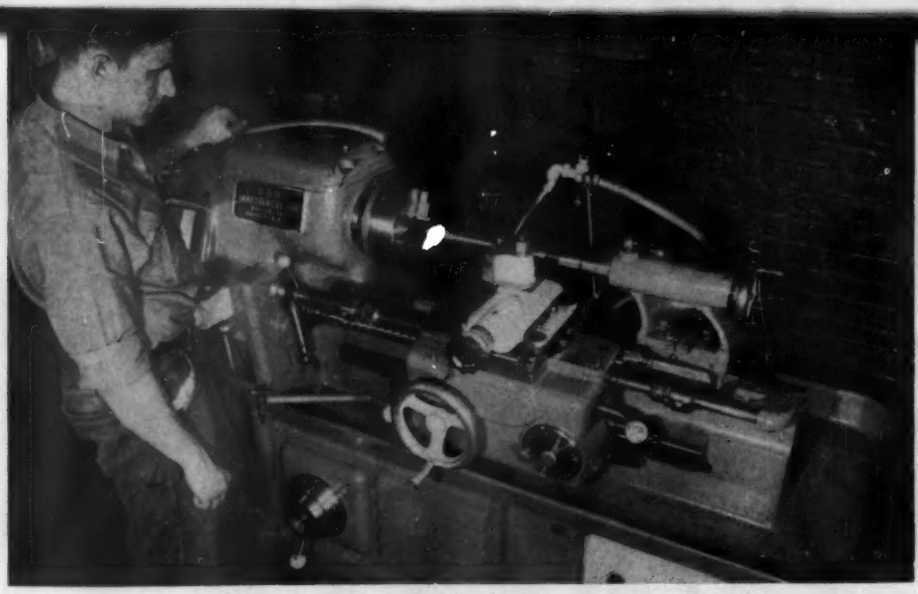
has the ID contour on its periphery and is brought into engagement with the bore after the internal machining is complete. After the bore is finished, the turret is indexed 90° to guide the tools that finish-face the forging, then is indexed again for contour turning the OD. Turret and templet must be in proper relationship, with the pitch of the lobes or rises in the forging to insure cleaning up when the parts are formed and cut off. Internal-contour templets and those for the OD are set up in relationship to each other to maintain wall thickness. Both ends are chamfered, and one shroud ring is cut from the cylinder after contour machining the ID and OD.

A second ring is then started by indexing the templet turret axially along the forging and stopping it by locating pins set up in accordance with length dimensions. The third shroud ring is made by the same process. The cut-off face is then ground and internal edges are broken in an Arter rotary surface grinder, where about 0.010 in. of stock is removed. Over-all length is held within plus or minus 0.001 in.

One of the most unusual machines in the line is a Sheffield Crush-Form grinder built especially for this work. A group of seven of these machines is employed to form grind the outside contour in the center of the periphery, the rib width around one end of the periphery and the outside pilot diameter which extends beyond the angular contour on the opposite end. Work is held on a segmented, precision expanding air-operated fixture that is spring-loaded to automatically clamp and unclamp the work. This device has the internal contour of the part on its periphery so that contour grinding the OD is relative to the contour of the bore. Three wheels are employed, one 24-in.-dia wheel that is automatically crush dressed to produce the principal contour, and two 7-in.-dia wheels for form grinding the rib and pilot diameters on either side of the main contour. The two small wheels are diamond dressed by units built into the wheel housings. All axial dimensions are held from the face previously ground, which is located against a faceplate through which the expanding fixture operates.

Several air-jet gages produce feedback control to compensate automatically for wheel wear as size is reduced. Tolerances are maintained by checking on a 4-column Precisionaire fixture which indicates rib and pilot dias as well as two OD dimensions. Wall thickness is held within 0.002 to 0.0025 in. in this setup and concentricity is maintained within 0.002 to 0.0025 in. TIR. Balance requirements within 3 oz-in. make wall thickness and concentricity especially critical. Surface finish must be 80 mu in. rms or better, actually runs about half this.

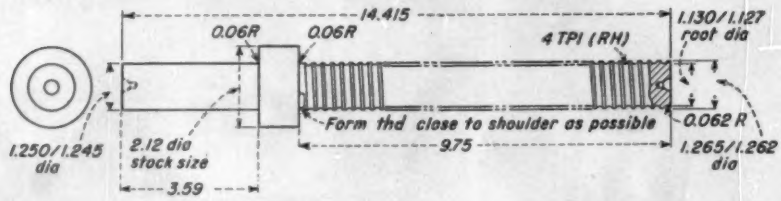
Final operations include polishing and burring wherever necessary, and washing to prepare for Magnaflux inspection. This is followed by another wash, then final inspection, balancing, and nickel plating.



Actuator screws up to 18 in. long are cut quickly, accurately, and automatically in this Man-Au-Cycle setup where the operator merely loads and unloads the work and starts the cycle. The machine is set for a predetermined number of passes (22 in this case), and a single-point carbide tool feeds into the work gradually to reach full depth at the final pass. Greatest depth of cut is at the start, gradually diminishing until finishing cuts are being taken. Three cams control total stock removal and the amount removed per pass

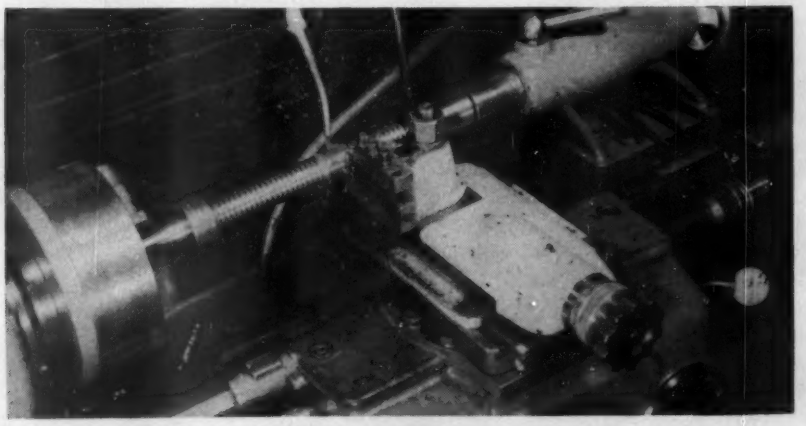
Thread cutting simplified, SPEEDED

A new approach to thread cutting employs a diminishing feed for roughing and finishing during each of several predetermined passes. Automatic cycling speeds the operation and permits an operator to handle more than one machine. Here's how Cleveland Pneumatic Tool Co jumped production of long actuator screws with this setup



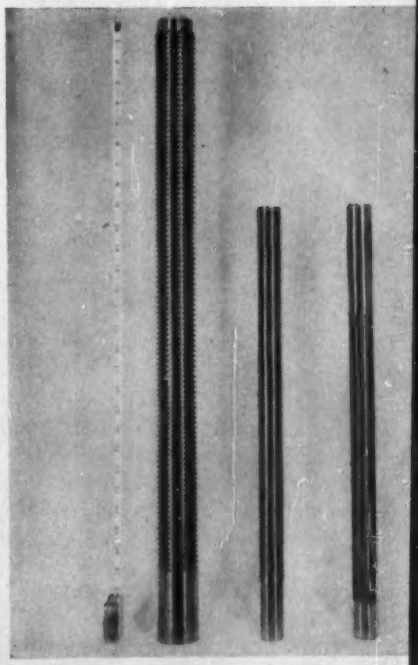
Typical actuator screw

is normalized 9310 steel. Threads are cut at 350 sfpm with a feed of 0.002 to 0.004 in. per pass, depending on the feed cam. Production rate is 20 pieces per hour—an increase of approximately 400% over conventional methods. Besides high production rates, advantages gained include greatly reduced distortion, high finishes, and the elimination of human error after the machine is once set up



Single-point

carbide-tipped form tool and soluble oil are used in machining actuator screw threads. The tool is automatically withdrawn at the end of each cut and automatically fed in to a predetermined depth at the start of each pass. A system of trips permits withdrawing the tool gradually or instantly for shoulder work. In this setup, tools are changed in less than a minute—changing pitch, dia, length of thread, etc, takes about 20 min. Features include an adjustable means of reversing the leadscrew and rapid return of the saddle



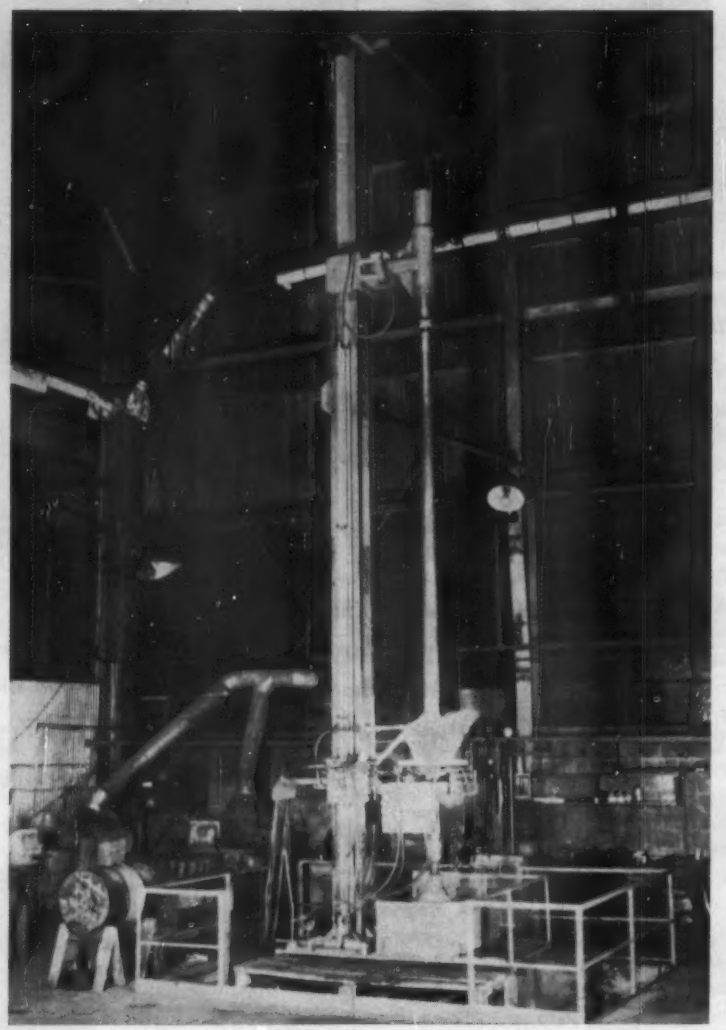
Threading time

for the screw at the left was 2 min 50 sec. This part is 30 in. long, 2 in. in dia and has 26 in. of 4-tpi Acme thread. Only 72 sec were required to produce 18 in. of 6-tpi Acme threads on the 21-in. long, 1¼-in. dia screw in the center. A V-thread 14 in. long was machined in the right-hand screw in 80 sec. This part is 21 in. long, 1¼-in. dia and has 12 tpi

Shopmade flame-hardening machine improves shaft quality

Because hardened bars and shafts are continually in demand for building and rebuilding machine tools at Simmons, we decided to construct our own flame-hardening machine. With fairly simple materials plus a lot of help from Linde Air Products Co a div of Union Carbide & Carbon Corp, we have developed and built a machine that does an excellent job and keeps the costs down

PATRICK J BRUNO, works manager,
SIMMONS MACHINE TOOL CORP.
ALBANY, NY

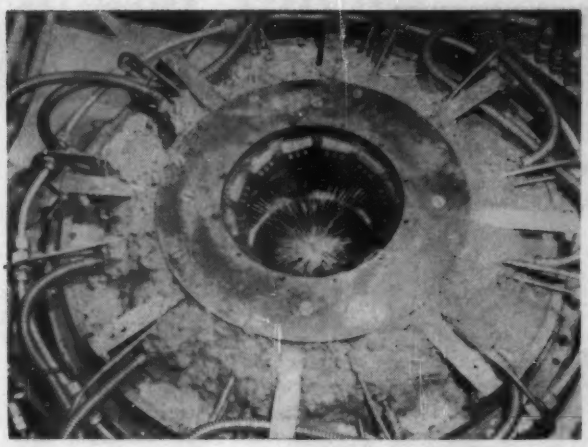


FLAME-HARDENING setup handles bars up to 8 in. dia by 20 ft long in very little space. Motors are in pit in floor. Note that I-beam main column is braced to vertical column of building at middle and top. It is important that this support be axially parallel with the bar and the flame head

Flame hardening of bars, shafts, and other shapes such as leadscrews developed only a few years ago. It is a fast, clean, easily set up method; requires less space than furnace heat-treating equipment and has less tendency to warp or distort the piece. Also, flame-hardening provides a degree of localized control not found in any other technique.

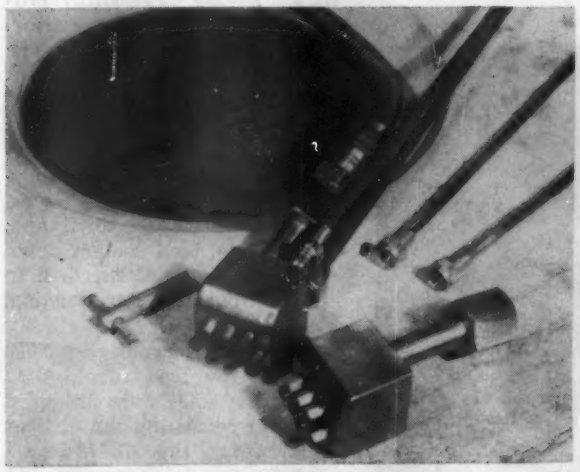
One of the first flame-hardening "machines" to come to our attention was, some years ago, built from an old engine lathe. The lathe was upended with the ways vertical and the headstock on the ground. Both the flame head and the quench ring were mounted on the carriage. Rotation of the bar and the carriage feed were controlled and powered from the headstock. The vertical position of the bar minimizes sagging, which not only would contribute to distortion, but might interfere with the flame head. Also, this position requires the least floor space.

In essence, our machine is developed on this principle. However, it provides capacity for shafts from 2 in. to 8 in. in dia and up to 20 ft long. Heat variation in the bar is a maximum of plus or minus 100F over the full length of bar. Hardening is held within R_c 57 - 62. Oxygen and acetylene are used for combustion; provide a flame temperature of 5750 to 6000 F at the bar. Thus heating is rapid. Bar temperature is controlled by the feed rate of the flame and quench carriage, which averages about 4 in. per min. but, of course, is varied for different materials and sizes, or conditions. Heating and quenching progresses from the bottom of the bar to the top. As the carriage reaches the top it trips a stop and is automatically stopped, the flame and quench water are shut off, and the carriage returns to the starting point. Then the carriage is released and the bar is removed and, at present, sent to an outside heat

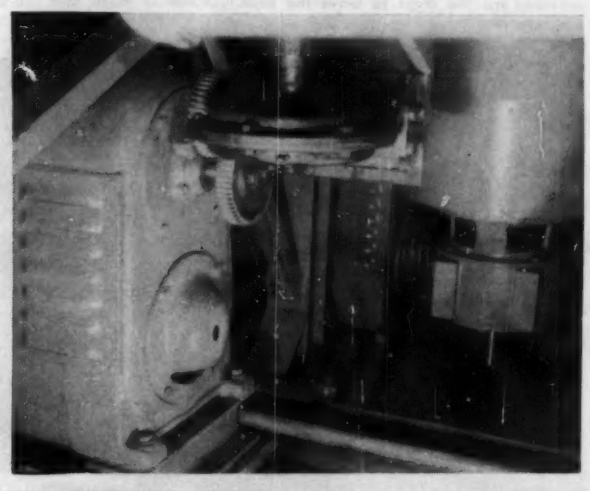


FLAME HEAD consists of individual oxy-acetylene burners focused at the center of the hole. Temperature of flame is 5750 to 6000 F. Asbestos cement is used to protect surrounding area

FLAME AND QUENCH CARRIAGE is cast iron; rides on brass ways on column and is provided with gibs for adjustment. Quench tank is below flame head. Tap water is pumped through it at 5 gal per min. Rate of feed determines temperature of bar



BURNER UNIT. Each hexagonal piece is a nozzle, easily replaced with the wrench shown. The number of units used to form a ring is determined by the size of the bar. Plate covers assembled head



TWO MOTOR-SPEED REDUCER combinations power machine and pump. Tap water, without special treatment, is pumped through the quench tank at 5 gpm

treater for stress relieving. If necessary, straightening is done in the shop.

Basically, the machine consists of:

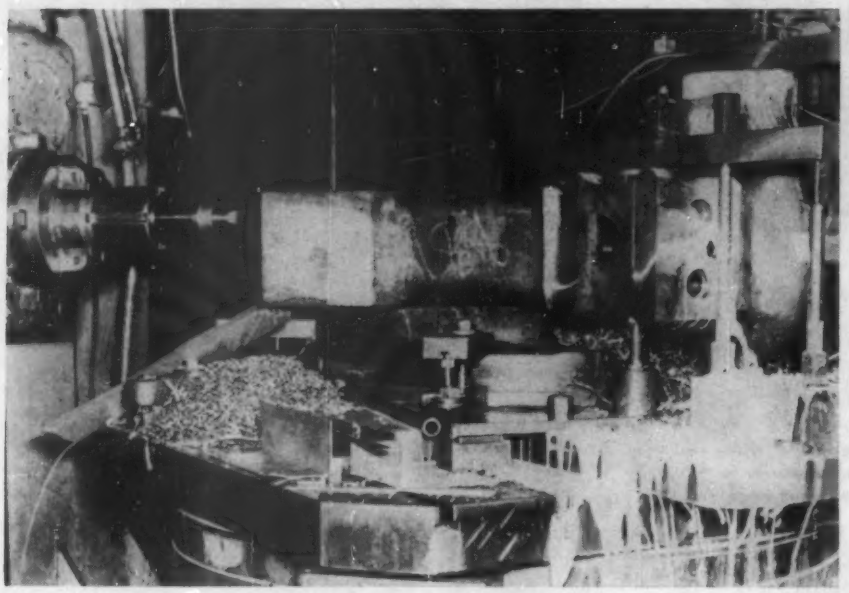
1. Flame and quench carriage
2. Supporting-center carriage
3. Driving center
4. Driving mechanism
5. Flame-head holder
6. Water tank and pump
7. Main column

The main column, a structural I-beam, supports the entire unit. It contains a leadscrew for the feed and is equipped with brass ways as a bearing for the flame and quench and the supporting carriages. At the top of the column is a supporting center for the upper end of the bar. This device includes an air cylinder, 6 in. dia, which compensates for expansion as the bar is heated. The cylinder is fed from the shop air line, about 94 psi, but the pressure to the cylinder can be metered depending upon bar dia, etc. Too much pressure on a slim shaft could distort it. This support includes a knuckle joint to permit alignment of the bar.

The driving center is at the base of the machine. It, along with the feedscrew, is powered by a 3-hp electric motor through a worm-gear speed reducer. The bar is rotated at 70 rpm.

While each bar may be treated with slight variations, usual starting practice is to place the bar on the driving center through the flame-head holder, the water tank, and the carriage. Then the supporting center is lowered to engage the upper end of the bar and the compensating air pressure is set. Next the drive motor is started and the flame heads are lighted. Finally, the flame and quench carriage feed is engaged.

ROTATING THE DRILL, rather than the work, for deep holes and close tolerances, greatly broadens the use of conventional shop machine tools for these operations. It is made possible by a fluid transfer at the driving end. Transfers can be made in the shop or purchased, depending upon the pressure and the speed on the rotating seal. In a job of this kind, plenty of clearance must be provided for the chips to leave the hole, yet not so much that the cutter is improperly supported



PART IS SET UP on rotary table of horizontal boring mill and holes are started with a centerdrill, then continuously drilled to 26-in. depth with the spade drill. Chips must be kept small to prevent them from jamming in the hole

SPECIAL SPADE-DRILL SETUP
drills deep holes in large work

To produce deep holes in large castings, odd-shaped forgings, or weldments, many companies are forced by material or equipment limitations to drill without rotating the work. While, for a production job, gundrills would solve this problem with greater speed and accuracy, this special equipment is not always available in the correct diameter, and the setup is expensive. Here is another way to solve the problem

L C KEHN, Jr.
manager, manufacturing engineering
SMALL TURBINE &
SUPERCHARGER DEPT.
GENERALE ELECTRIC CO.
FITCHBURG, MASS.

Our job was to drill a number of 1⅞-in.-dia holes to a depth of 26 in. in some moly-vanadium-steel castings, and break into another hole at full depth, hitting within 1/32 in. of center. The holes were to be steam passages in a high-pressure steam vessel and could not be successfully produced by coring the casting. Because the part weighed one ton and we had no equipment capable of rotating it and achieving this accuracy, the job had to be done on a horizontal boring mill. With the work stationary, it was necessary to rotate the drill and, meanwhile, feed coolant down the full length of the drill to prevent burning, chip clogging, and wandering.

Drilling at 69 rpm, with 0.008 in. per rev feed (about 9/16 ipm), the holes were produced without retracting the drill or interrupting the cut. With six holes successfully completed in each piece, drill wander was a maximum of 0.015 in.

Equipment consists of a special, carbide-insert-tip, single-blade spade drill 33 in. long. The shank is tapered, with a flat milled along one side, and it contains a ½-in.-dia coolant-feed hole through its center which carries coolant, under pressure, to discharge points at both sides of the cutting blade.

A special coolant-transfer chuck was built to both drive the drill and feed coolant through the shank as it revolved. The chuck has a No. 7 MT shank to fit the machine and contains a No. 5 MT bore to receive the drill. Soluble oil mixed 50 to 1 with water is piped directly to a stationary section of the chuck at about 50 psi from the coolant pump used with this machine.

Round Table

Salesman for a day

"I think it's a hot idea, Ed; sending out a machinist or setup man with a salesman for a day's work. It might show the men that getting a profit to pay their wages isn't as easy as they seem to think."

"What's a machinist care about sales work, Al? It's not his job, so why rub his nose in it?"

"For one thing, it'll give him an idea of what happens to the job he works on after it leaves his machine. Might be very educational."

"Sure; so is a book. But I can't see any point in making a shop man carry a salesman's brief case around a whole day. It's not going to make a salesman out of him; and it sure won't make a machinist out of the salesman. And, what'll it do to my production schedules?"

"That's not the idea, Ed. What Management is getting at is the narrow attitude most shop men have about things outside of their own departments. Everybody ought to know a little something about what happens to the product. It should give some meaning to the work we do here."

"All the meaning most of the men here understand is that weekly pay envelope, Al. I doubt if there will be many volunteers for this crazy scheme."

"Even if we only get a few shop men out, Ed, it's worth the effort. A lot of these guys think of salesmen as fast-talking slickers who get too much money for selling a product that really sells itself. If they'd get exposed to the real facts, they might have a little more respect for salesmen —and maybe for other people who don't work in the shop."

"There's no point to it, Al. Do you think a machinist will work better if he knows how tough it is for a salesman? I doubt it."

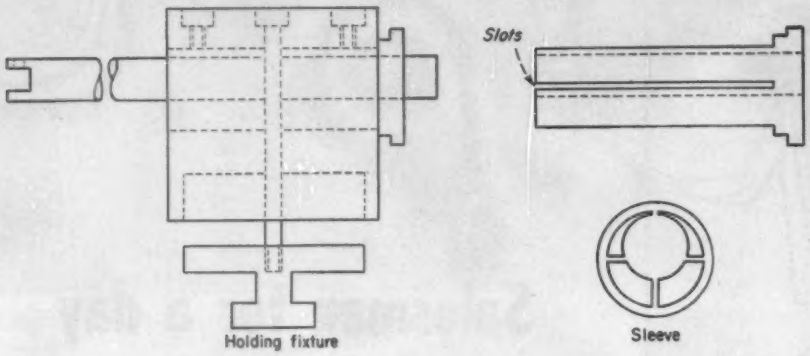
"Maybe not, Ed; but at least he'll have some appreciation for the problems of other people in the company. And that might help smooth things out a lot."

"For my money you can leave the shop men in the shop, and let the salesmen do the selling. Let a man handle his own job, Al. He's the one that knows it."

"But it might help a shop man do some constructive thinking about his own job if he knew a little about the other jobs that contribute to the product."

Let the shoemaker stick to his last; or get everyone to pitch together? Can a broader knowledge of the company's operations improve shop work, or is this just a new way of wasting time? Your opinions may guide others. Discussions of earlier topics start on page 212.

Practical Ideas . . .



Split Sleeve and CRS Block Make Deep-Hole Boring Bar

During the war we were faced with the perplexing problem of boring a large number of small-diameter, deep holes to close tolerance. There were no skilled lathe operators available for this job, and we had to depend on machine attendants and setup men.

The job called for a stiff boring bar which carried an inserted toolbit of maximum diameter consistent with chip clearance. To permit maximum diameter, the bar had to be held parallel to the axis of the bore. The ordinary bars we had on hand did not begin to meet these requirements.

Because industrial tools were virtually unobtainable, we designed and built the fixture shown here, completing the job with great success. These fixtures in various sizes have been used on lathes from 9 to 14 in. ever since.

A rectangular piece of CRS was fastened to the lathe compound by the arrangement shown here, and bored with a fly-tool mounted between centers. A round piece of CRS was turned to a sliding fit in the bore. The round piece was then held off-center in a 4-jaw chuck and a hole was bored through it to hold the hardened bar. This sleeve was then slit to the shoulder by making four equidistant cuts with a slitting saw on a miller.

With the boring bar and sleeve in place, a slight rotation of the sleeve raises or lowers the toolbit. Rotation of the bar in the sleeve presents the correct angle of the bit to the surface being machined.

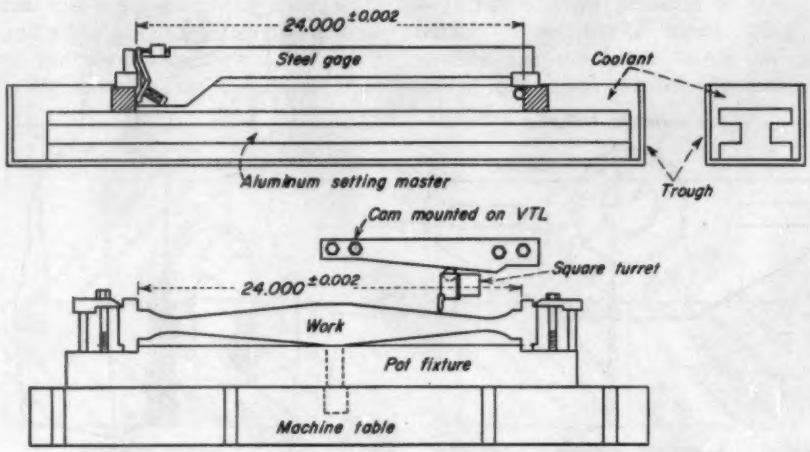
When these adjustments are made, the bar is locked firmly in position by the two hex-head capscrews. The fixture may be removed from the lathe compound and replaced without changing the position of the toolbit. If smaller bars are required, secondary split sleeves reduce the diameter of the bore of the original sleeve.

It can be seen that precise radial and vertical adjustments of the toolbit can be made very quickly. The fixture has the added advantage of holding the bars parallel to the bore. Because of this parallelism, and the precise adjustments, the only limit of diameter of a bar for a given bore is chip clearance. *Lawrence A Patrie, Fredonia, NY*

Simple Holder for Pocket Magnifier

Often the use of a pocket magnifying glass in the shop requires the presence of a "third hand" to hold either the work or the glass. I like to use the method shown here to hold the glass. An ordinary surface gage has an adapter which supports the glass, while both hands are free to hold the work.

The adapter is simply a small block of soft wood, cut to a tight fit into the opening of the magnifying glass case. A hole has been drilled through this block to make a tight friction fit over the scriber on the surface gage. The whole combination is easily adaptable to almost any situation where the glass is being used. *H J Gerber, Stillwater, Okla*



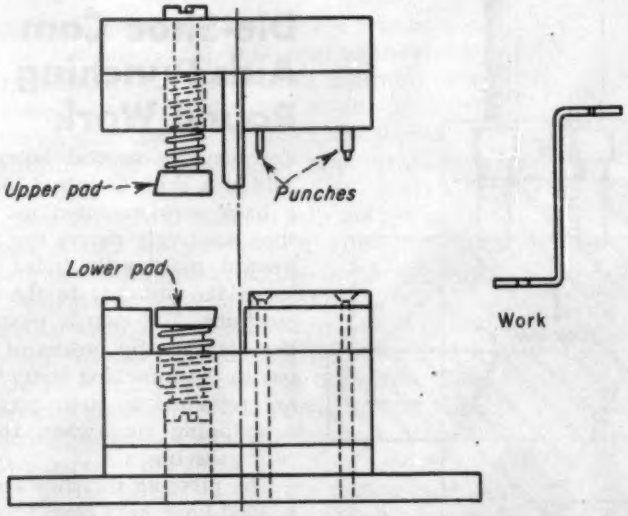
Coolant-Filled Trough Helps Check Aluminum Rotor Wheel

Holding tolerance when machining aluminum is one of the difficult problems that the machine shop has to overcome. For example, we were making an aluminum compressor rotor wheel, shown here, which has a 24.000 ± 0.002-in. internal dimension to keep. Trouble occurred when the wheel was being cut to the 24-in. dimension on a 36-in. VTL in the summertime. A coolant, kept at 70F by a chilling unit, was used during machining.

On a bench beside the VTL were the gage and aluminum setting master which were used to check the finished dimension. The shop temperature was 85F.

After the 24-in. surface had been checked, the rotor wheel was taken off the machine and sent to final inspection, which also had a surrounding temperature of 85F. The inspector, using the same kind of gages, found that the 24.000 dimension was 24.0064, or 0.0044 in. over the tolerance. Because of the temperature difference, the wheel had expanded to outside- tolerance size.

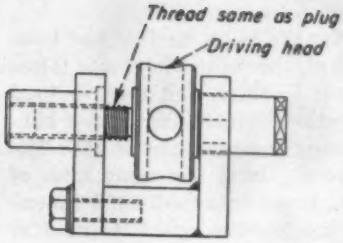
This condition was corrected by mounting a trough on the side of the VTL and piping coolant lines to the trough, in which was placed the aluminum setting master. The coolant flowed over both the wheel and master, so that the gage was set to the proper base size. The inspector was called over to inspect the part on the machine, rather than waiting until the part reached his department (and heating up until oversized). *R O Andrews, E Detroit, Mich*

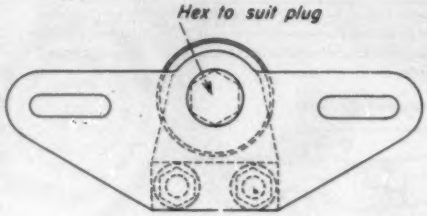


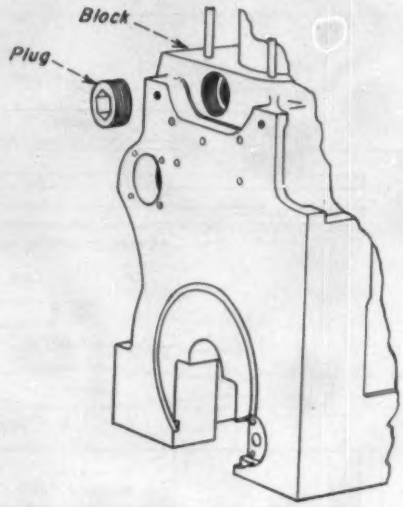
Double-Acting Die Cuts One Operation From Job

We had to make the double-bend piece shown here, in which there are two holes, one at either end of the flats on the work. At first we thought of doing the holes in a shear die drill jig, and then bending the piece in a conventional bending die.

This would have been too expensive, so we designed the die shown in the sketch, to do the entire operation in one step. In action, the ram descends, and a spring pad holds the stock during cutoff. As the ram continues to descend, the left side of the shear die bends the stock 90°. The punch spring pad then hits a stop, and the die spring pad starts downward, until the ram is 1/16 in. from the bottom of the stroke. Then a punch punches the 2 holes which will be in the next piece. *Victor Stuart, Westfield, NJ*





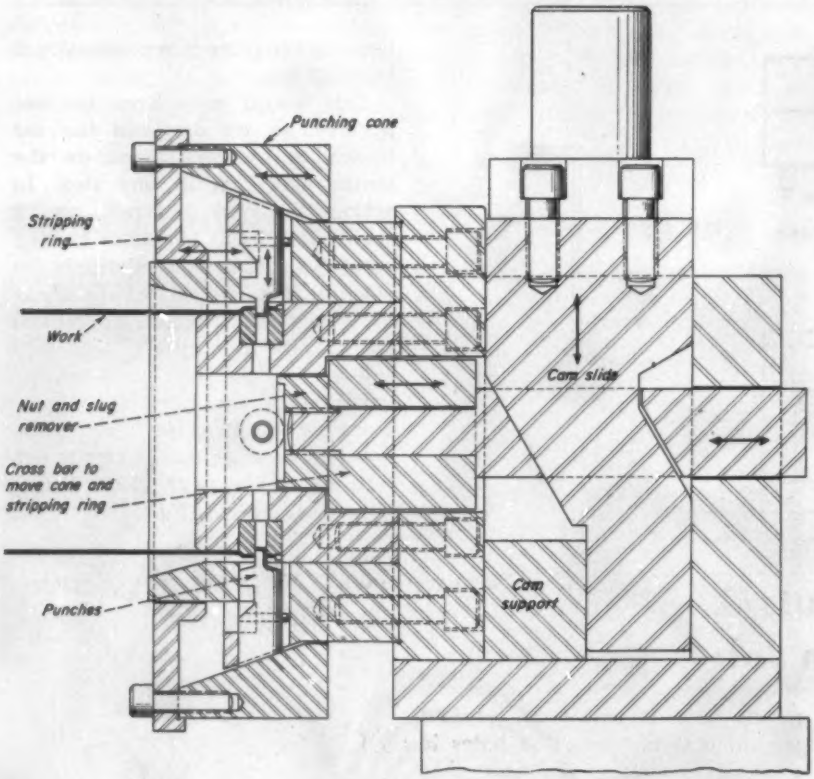


Device Helps Insert Hex Plug In Cast Recess

The assembly of plugs used for sealing core holes in the end of crankcases was giving us trouble. Plugs were cast iron, with the hex recess having a draw angle. Because the plugs had to be fitted tightly on the thread, to be leakproof, ordinary wrenches were inefficient. They kept slipping out of the recess while we tried to get the plug seated tightly enough.

The device shown here was developed to overcome this trouble. A hardened hexagonal head is threaded at the back, to the same pitch as the core plug. This thread works in a threaded bushing which is press-fitted to the device, insuring that the hex head advances at the same rate as the plug.

The plug is started by hand, and the device is positioned with the head engaged in the recess of the plug. Then the holding screws are fastened in the crankcase head. A 3-ft bar is used in this case to operate the driving head, being inserted in the large holes provided in the periphery of the head *R B*
Wolverhampton, London, England



Die-Shoe Cam Aids Punching Round Work

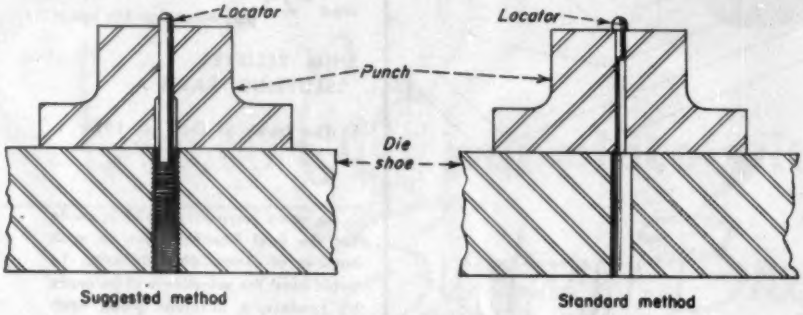
For piercing several holes in the side of a shell or into a long pipe, a back cam mounted on the die shoe positively moves the punches inward, making the holes, and returns the punches to the original positions. The cam is mounted on the die shoe by means of a cross bar to the punching cone. Punches are returned to their position by a stripping ring when the press ram goes up.

The piercing punches are of the headed type, kept from rotating by hardened pins. The cam, slide, and cone are also heat-treated. The holder for the punches should be soft tool steel.

The die buttons are backed up by spacer washers when reduced by sharpening. Slugs pushed out of the work into the hole of the die

button holder are ejected by a special nut fastened to the slide. Cam and slide are shown at the bottom of the press stroke.

When designing slide cams, the angle is generally 30° to 35°, but it is not always possible to stay within these limits when long strokes are involved. These formulas are also helpful. Vertical travel = slide travel x cot. cam angle; slide travel = vertical travel x tan. cam angle. *Valdemar Liima, John Wood Co, Ltd, Toronto, Canada*



Removable Locator Design Aids Repositioning Work

When building compound shaving dies with small round locating pins, as shown here, above, we used to machine a small tenon on the locator and press it into the punch. If this design were used in a high-production die, the locator would have to be knocked out whenever the punch was sharpened. This continual removal of the locator would eventually result in a loose fit between the tenon and its mating hole. The loose locator might come out of the die with the part.

To remedy this condition, we now use locator pins as shown here in the new design. The locator is silver-soldered to a socket setscrew and locked in place with a setscrew, as shown. With this design, the punch may be sharpened by simply removing the locknut and moving the locating assembly down. When the die is in use, this kind of locator cannot be lifted out of the punch because it is always securely retained. *F C Elmo, Dayton, Ohio*

Gear Assembling Fixture Lines Up Close Tolerances

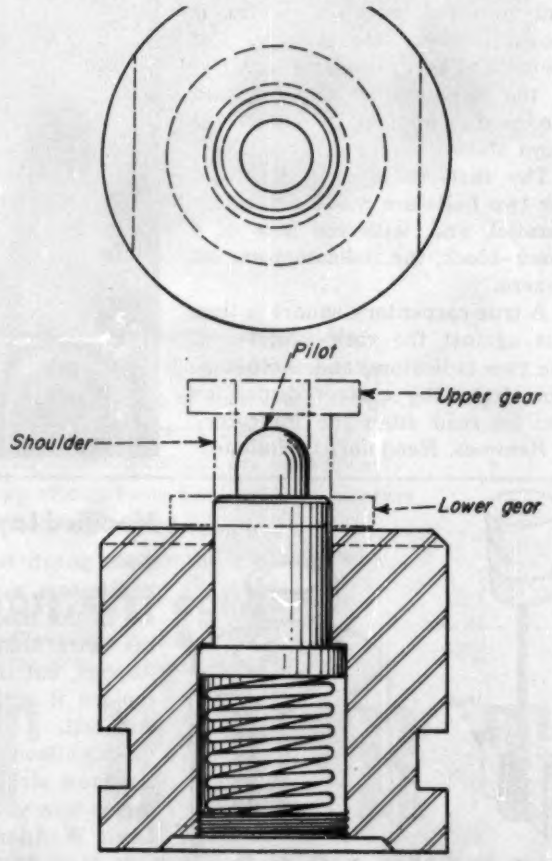
To assemble two gears, a special fixture was needed to insure correct lineup of the first gear on the shoulder of the second. The problem of assembly was further complicated by the fact that the shoulder on the lower gear had to be machined 0.0005 in. larger than the bore of the upper gear, to make a press fit.

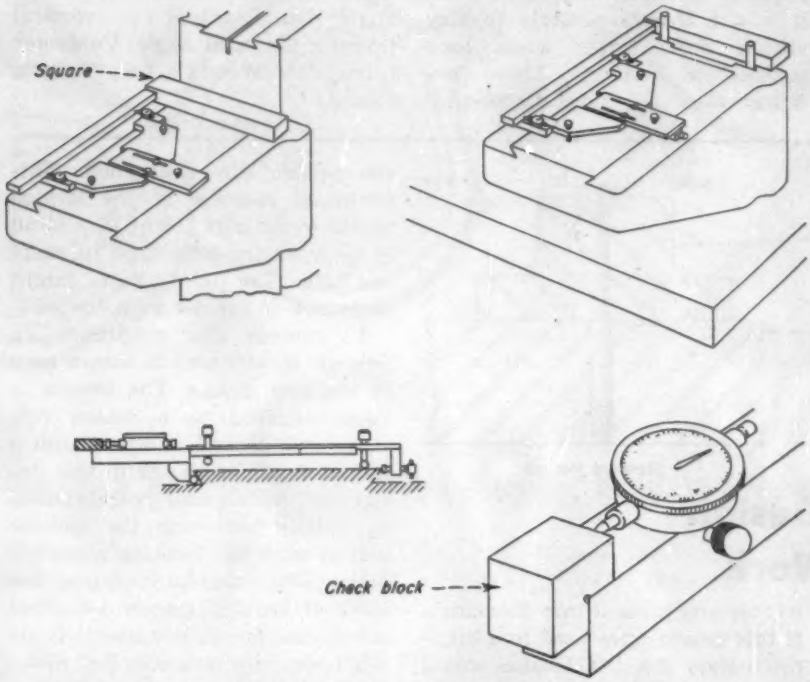
The fixture shown was made to help the assembly. The centers of both gears are kept in alignment until they are assembled, and the gear teeth are kept from being damaged during the operation.

The circular steel body of the fixture has two slots milled across the OD for clamping purposes, and it is bored to receive the diameter of the guide. This guide is made a sliding fit, which moves up and down freely during operation, and it is made a snug fit for the two bores of the gears.

A heavy spring in the base of the fixture is held in place by a setscrew, by means of which tension on the spring can be adjusted.

In operation, the gears are assembled onto the aligning guide of the fixture. An arbor press ram forces the upper gear into the lower one, the spring and guide backing off as the gears come together. The release of the ram permits the assembled unit to be removed from the guide. *Alex S Arnott, Toronto, Canada*



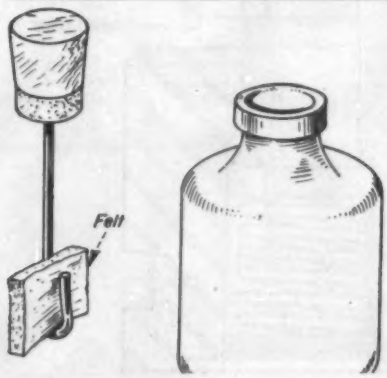


Another Dovetail Measuring Device

Another tool to check both internal and external dovetail guides is shown in the sketches here. The surfaces to be checked are scraped in the conventional manner, and the gage is applied in one of the ways shown.

The surfaces of both legs and the two balls are made accurately parallel, and, with the help of a check-block, the indicators are set to zero.

A true carpenter's square is then put against the rack spindles of the two indicators, and the deviation from the correct dimension can be read from the indicators.
J Hemmes, Hengolo(o), Holland



Modified Layout Dye Dispenser

Shoe polish bottles with modified applicators, as shown, are a definite aid in the machine shop. We take the wire that extends from the stopper, cut off the felt ball, and replace it with a small square of stiff felt.

This allows either a large area or a narrow strip to be dyed, depending on how you hold the applicator.
Louis W Adams, Little Rock, Ark

Winner No. 237

SEBASTIAN MILARDO,
Middletown, Conn

won $25 in addition to regular payment for his idea:

SHIM RELIEVES SLOTTING SAWS

in the issue of Oct 10, 1955

An extra payment of $25 is made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

PAYMENT—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of issue. The winner will also be announced in these pages as soon thereafter as practicable.

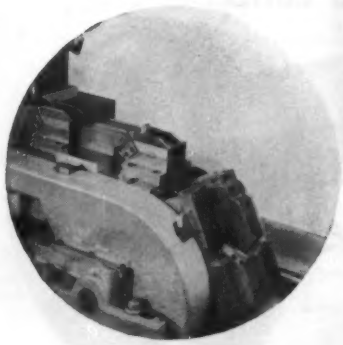
JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in a tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer, or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER—Anyone may enter except employees of the McGraw-Hill Publishing Co, Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N Y

Lower Cost per piece with Surface Broaching of small parts



■ Holding fixtures are designed for quick, convenient loading, with automatic clamping and unclamping

■ In many plants where large quantities of duplicate metal parts are being machined, substantial savings are being made through the adoption of surface broaching. Production is exceptionally high, close tolerances are maintained, and tool maintenance costs are much lower than with ordinary methods. Foote-Burt engineers, pioneers in this advanced machining method, have had a wide experience in applying surface broaching in many fields.

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TYPICAL CROWN-SHAVED TOOTH CONTACT AREA

This typical internal automatic transmission gear is crown-shaved in 24 seconds machine time with the tooling shown.

Amount and position of crown for any specific work unit is optional.

The Plunge-Cut Process is equally applicable to straight-tooth gears and with the same economy in shaving time.

If you are mass-producing internal gears, write for Bulletin S55-6 on Internal Gear Shaving Machine, Model GCR

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SHORT-CUT TOOL DRAFTING . . . I

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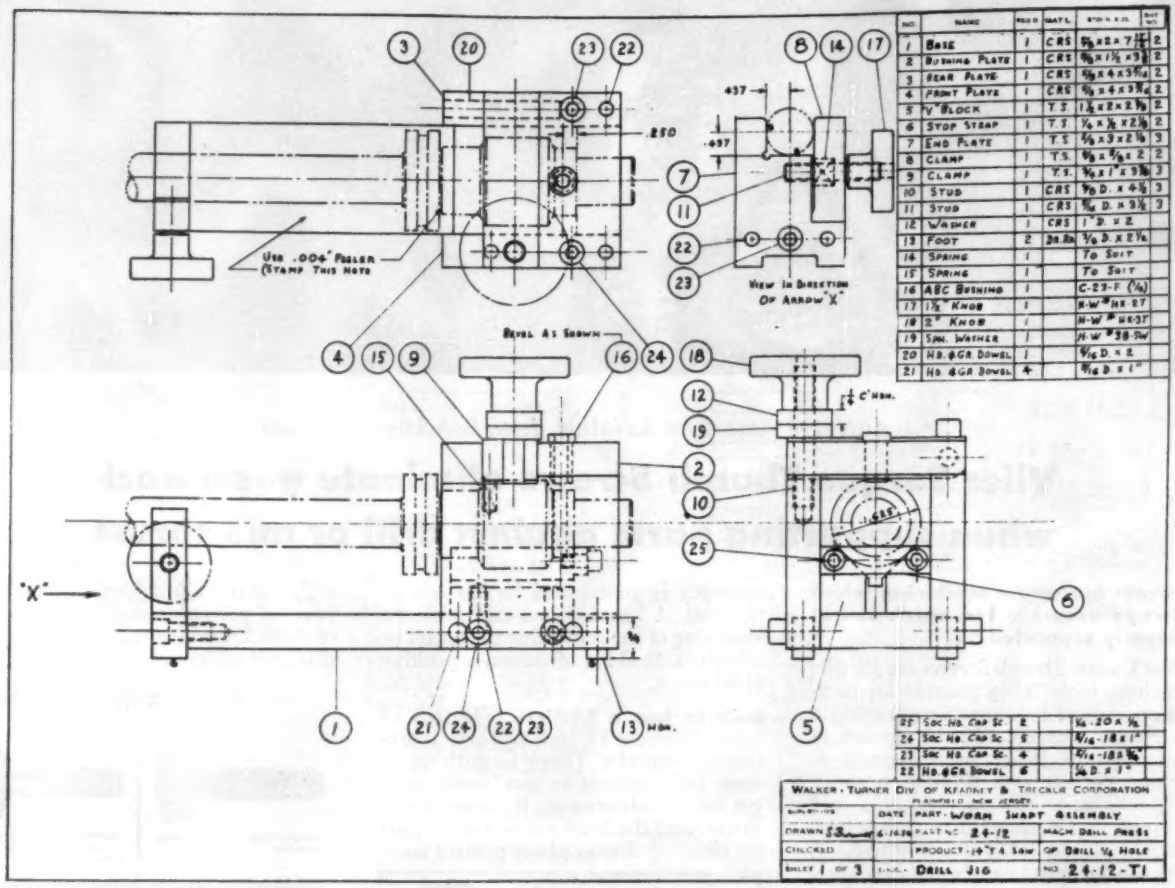


FIG 1 . . Drill-jig assembly drawing prepared with conventional drafting instruments

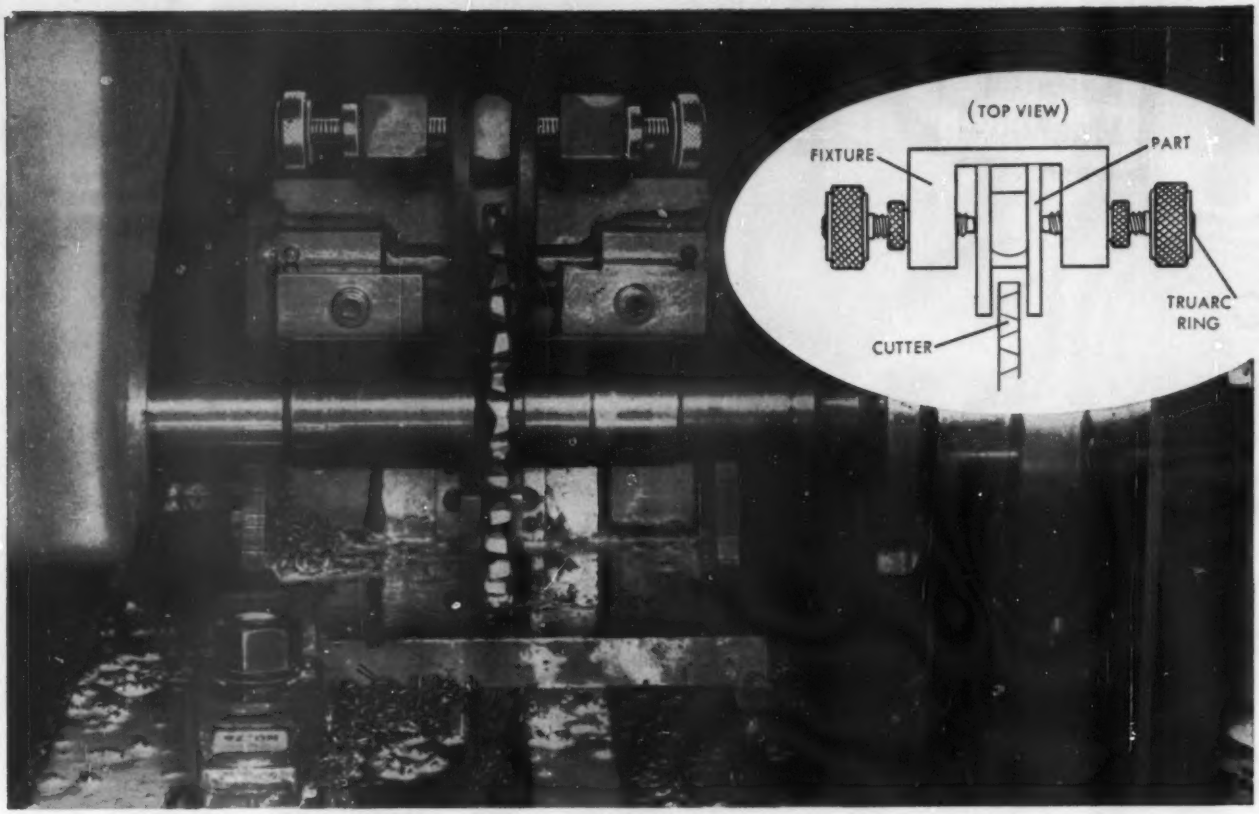
Do you want to cut 25% from your tool-drafting time? It can be done by a method successfully used for over a year.

Ever watch a tool designer? He picks up, lays down, picks up, his triangles, compass, scale and half a dozen pencils. Much of this motion is unnecessary, as you may see from the accompanying detail drawings which were made with only a pencil and compass.

Convention and habit constrain us methodically to produce precise drawings. Is this necessary? If a company consistently sends drawings "outside," it may hesitate to exhibit working drawings that don't possess that conventional or "fancy" look. Where drawings are used in a captive toolroom, "fanciness" is a costly luxury. In a year of using these "short-cut" drawings at Walker-Turner not a single complaint has been heard from a toolmaker.

HERE'S WHAT YOU DON'T DO

1. Draw a border around the paper.
2. Draw and letter-in a title block.
3. Draw lettering guide lines.
4. Use upper-case lettering. (It's too slow.)
5. Use several grades of pencil. (One grade, used right, is enough.)
6. Use arrowheads on balloon leaders. (Arrowheads take a lot of time.)
7. Blacken in arrowheads for dimensions.
8. Try to make dimensions and notes read in the



...at North American Aviation, Inc., Los Angeles Division:

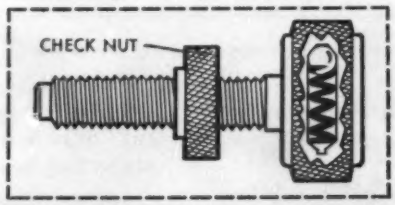
Vlier Torque Thumb Screws eliminate guesswork when supporting parts against drill or mill thrust

Prevent inaccurate machining which always occurs when work is not properly supported...

Vlier Torque Thumb Screws are simple, precision tools. They provide an accurate means of holding or supporting a part with a predetermined amount of end pressure. When used beneath or behind cutters as a positive support, they eliminate chatter, vibration and prevent deflection of the part which would result in loss of size. *Even fragile, thin-walled parts can be held securely against machining pressures without distortion.*

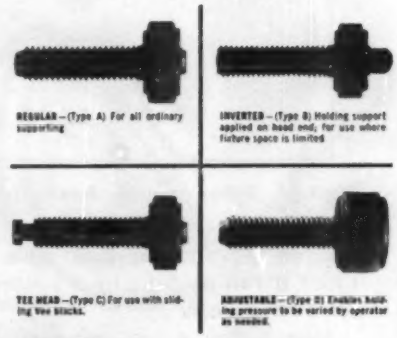
Impossible to overtighten... The head of the Vlier Torque Thumb Screw is designed with an *accurate*, spring-controlled ball-check which functions *automatically*. When the predetermined supporting pressure is reached, the head rotates freely, *preventing overtightening of the screw.* Spring pressures are determined at the factory and accuracy is guaranteed for the life of the tool. A knurled lock-nut prevents loosening of the screw due to chatter or vibration. Backing off action is positive at all times.

Built to last a lifetime... Design of Vlier Torque Thumb Screws is extremely simple. There is nothing to wear out; nothing to jam; nothing to get out of adjustment. By removing a Truarc ring the head can be taken apart for cleaning. Cover plates protect moving parts from dust, chips, etc., assuring years of profitable use. Order a supply of these money-savers from your Vlier distributor today.



In the Vlier Torque Thumb Screw spring pressure is applied perpendicular to screw axis, eliminating inaccuracies due to wobble or "slop" as wear occurs.

Available in four types; 19 models


REGULAR—(Type A) For all ordinary supporting
INVERTED—(Type B) Holding support applied on head end; for use where fixture space is limited
TEE HEAD—(Type C) For use with sliding Vee blocks.
ADJUSTABLE—(Type D) Enables holding pressure to be varied by operator as needed.

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SHORT-CUT TOOL DRAFTING . . . II

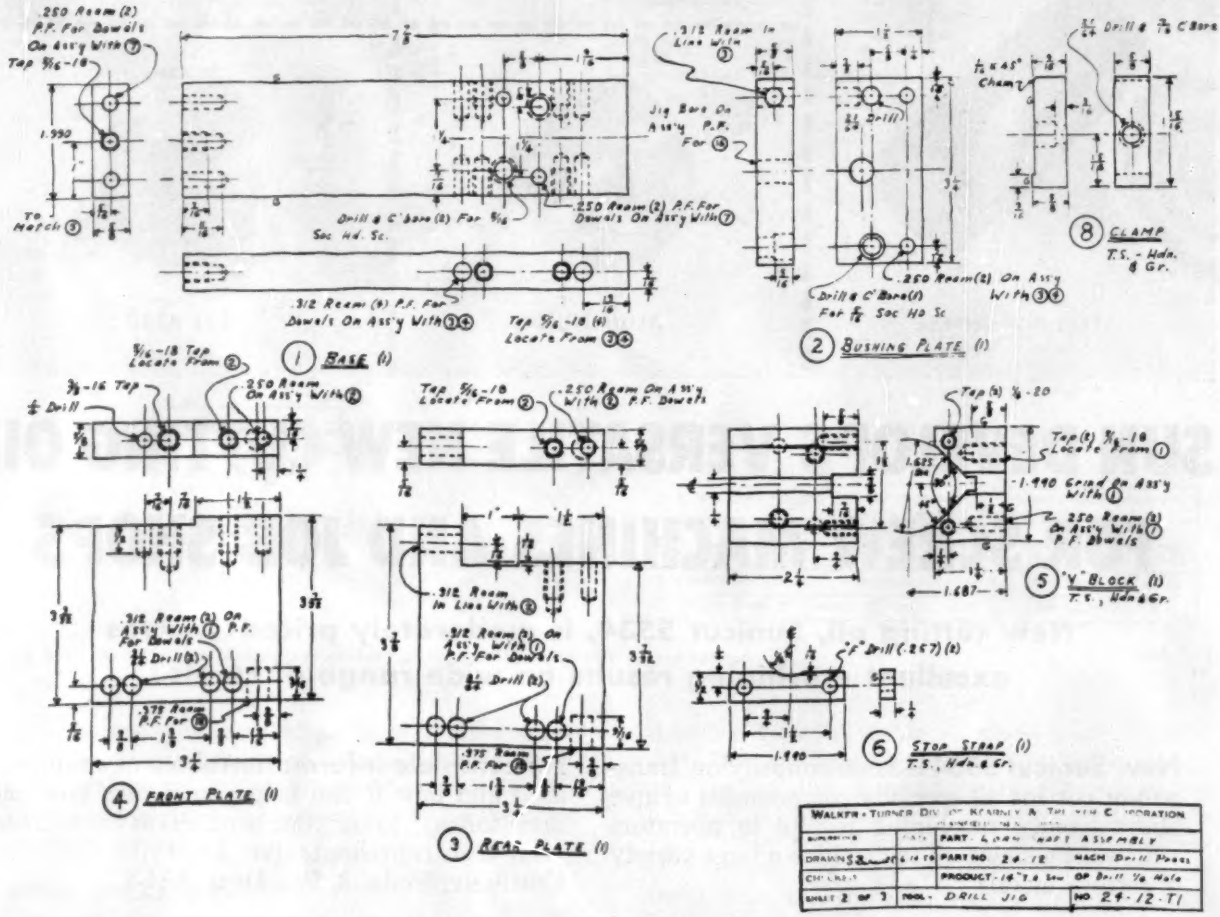


FIG 2 . . Details of the jig are traced freehand from the assembly drawing

same direction as their dimension lines. (The shop man likes to stand upright while he reads a print.)

9. Use a dimension and attendant lines when a note will give the same information quicker.

10. Use instruments (except compass) for detailing.

11. Use large sheets of paper when it's possible to use small sheets.

HERE'S WHAT YOU DO

1. Use paper with printed borders or skip the borders.

2. Use printed or paste-on transparent title blocks.

3. Use eight-to-the-inch graph paper under your tracing to guide your lettering.

4. Use sloping lower-case lettering to double speed.

5. Use one pencil for everything. Learn to lean heavily or take it easy.

6. Apply free-hand leaders with open arrowheads for notes; they're several times as fast as instrument-drawn leaders.

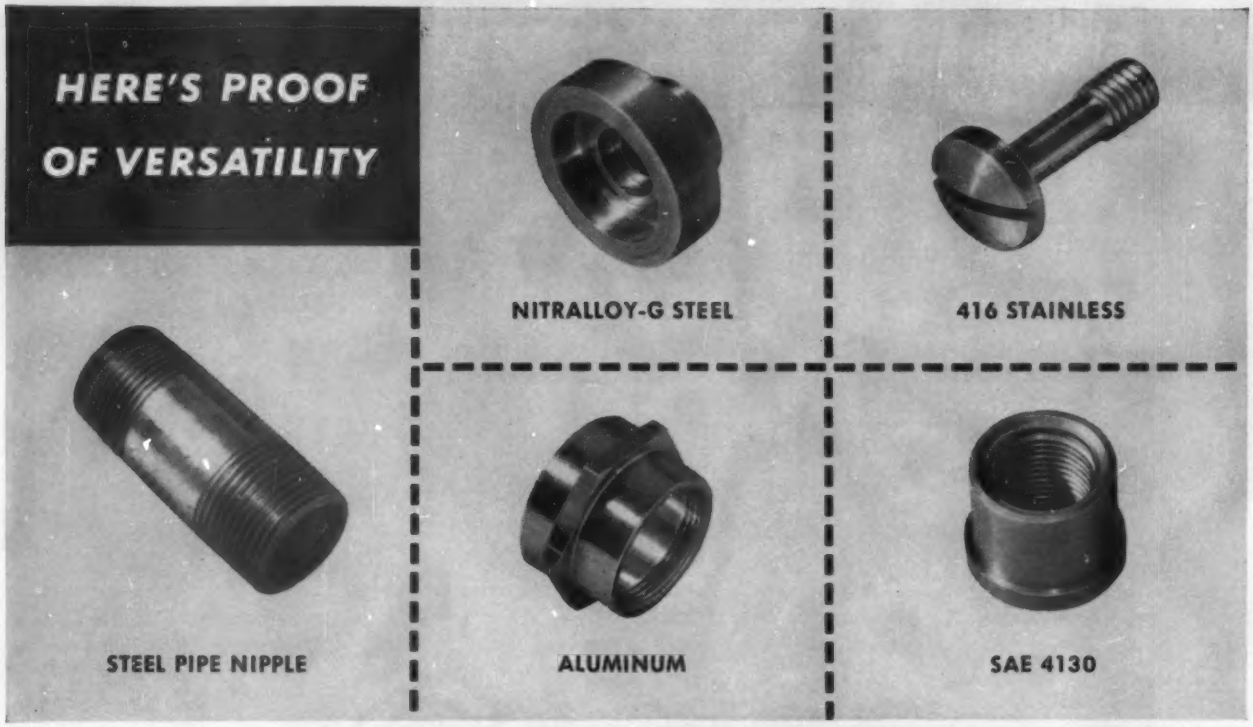
7. Make all dimensions and notes read from the bottom of the sheet.

8. Use a compass for circles only. Draw radii free-hand.

9. Use instruments on your assembly drawing; it must be accurately to scale.

10. Always draw the assembly on a separate sheet.

11. When tracing off the details, group turned



SUN DEVELOPS VERSATILE NEW CUTTING OIL FOR SCREW MACHINES AND JOB SHOPS

New cutting oil, Sunicut 5534, is moderately priced... gives excellent machining results on wide range of steels

New Sunicut 5534 is a non-emulsifying, transparent cutting oil specially compounded to give above-average machining results to operators who want a single oil to machine a large variety of ferrous metals.

Tests have proved that new Sunicut 5534 meets this demand for an all-purpose cutting oil. It is ideal for general screw machine and turret lathe work. It is also excellent for tapping, drilling, threading, and light stamping operations. In addition, new Sunicut 5534 can be used on many special machining jobs, both high and low speed, with metals ranging from B1112 to 4130 as well as free-machining stainless steels.

For complete information about new Sunicut 5534 and how it can help you reduce your oil inventories... lower your production costs... see your Sun representative. Or write SUN OIL COMPANY, Phila. 3, Pa., Dept. AM-12.

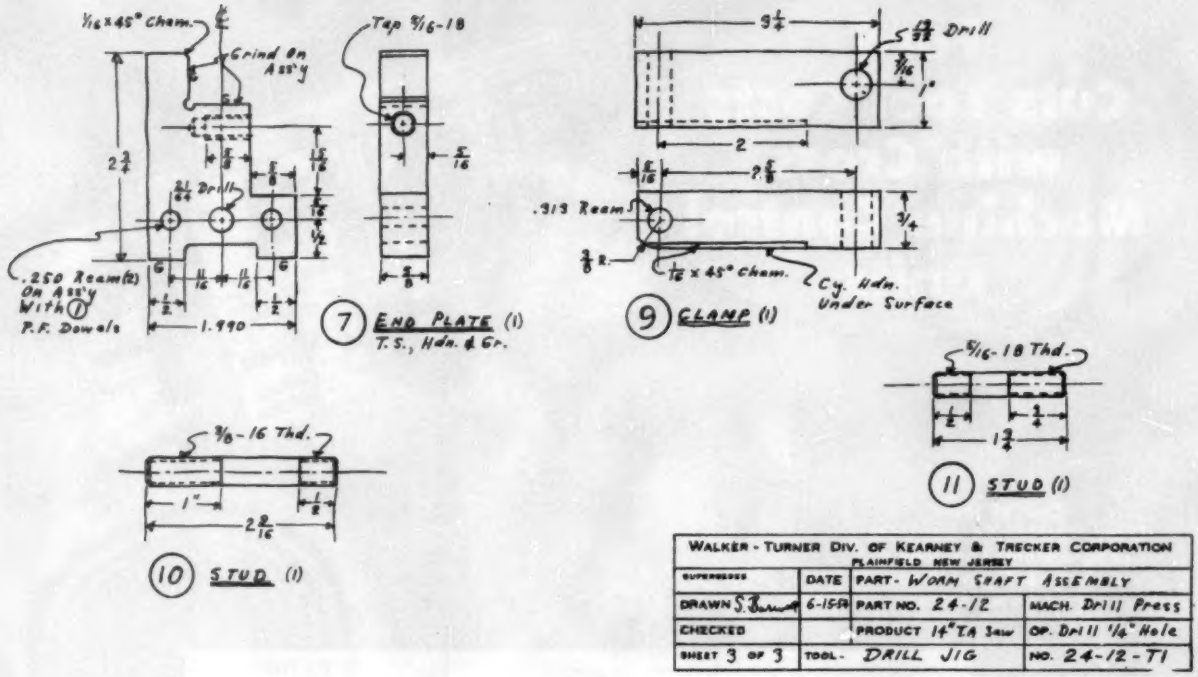
SUNOCO®

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY, PHILADELPHIA 3, PA.

IN CANADA: SUN OIL COMPANY, LTD., TORONTO AND MONTREAL

SHORT-CUT TOOL DRAFTING . . . III



WALKER-TURNER DIV. OF KEARNEY & TRECKER CORPORATION PLAINFIELD NEW JERSEY			
SUPERSEDES	DATE	PART- WORM SHAFT ASSEMBLY	
DRAWN S.T.	6-15-55	PART NO. 24-12	MACH. Drill Press
CHECKED		PRODUCT 14" TA Saw	OP. Drill 1/4" Hole
SHEET 3 OF 3	TOOL-	DRILL JIG	NO. 24-12-T1

FIG 3 . . More freehand details give an idea of time savings of Walker-Turner method

parts on one sheet, milled parts on another sheet, etc. This allows division of labor in toolmaking.

12. Make detail drawings complete so no reference to the assembly drawing is necessary by the toolroom machine operator.

OTHER APPLICATIONS

Considerable advantage is obtained from the method for drawings up to "D" size, (22x34 in.), but its use on larger work is not recommended.

Tool drawings are not the only place where less "fancy" drawings have been used to advantage. Two Walker-Turner experimental-machine projects were substantially "hurried-up" by use of these short-cut drawings.

STEPS IN METHOD

1. Draw assembly of tool accurately by conventional method, using instruments, on a sheet of tracing paper just large enough for it. Work carefully to scale.

2. On one or more separate, and usually smaller, sheets of paper trace off all outlines of each detail from the assembly drawing, free-hand. Spacing presents no problem; space is left where needed for additional views of the detail which must be added later. During the tracing operation the drawings are free on the drawing board. They may be turned in any direction or brought down within easy reach. Only one grade of pencil—comparatively soft—is used. Use light pressure. Now put in all circles with the compass, then trace all outlines and hidden lines with heavy pressure on the same pencil as used for centerlines.

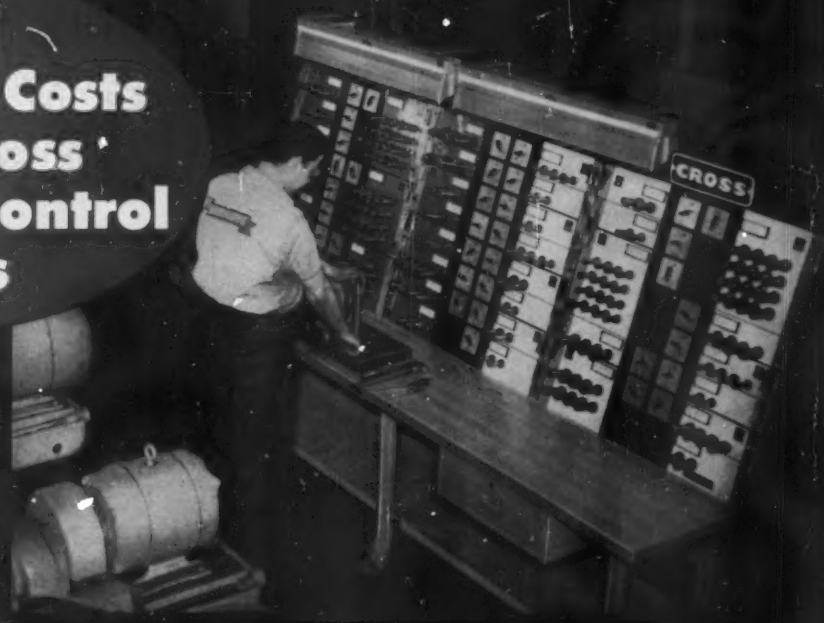
3. Tape each detail sheet to a sheet of 1/8 x 1/8 in. ruled graph paper (18 x 24-in. size), and complete the detail drawing "free-hand" by using the lines of the graph as a guide and scaling dimensions from the assembly drawing. Use a scale to determine size of parts; you'll be surprised how accurately you can scale them. For best results use a lightweight tracing paper rather than the usual heavy treated papers. Prints by the Ozalid process come out clearly.

Does this free-hand drawing sound difficult? The real "free-hand" work is limited to the small radii. In all other cases you aren't really drawing "free-hand" at all, but just tracing the lines from beneath.

The "free-hand artwork" is easy. Try it. The savings in time are real.

A Mechanical Eye...

Ford Cuts Tool Costs with Cross Machine Control Units



One of the Cross Machine Control Units at Ford Motor Company's Cleveland Engine Plant

(U. S. Patent Nos. 2679038 and D-163935. Others pending)

According to records, 221 Cross Machine Control Units in operation at Ford Motor Company Plants are assisting them greatly in improving tool trouble conditions.

One reason for this is that the Machine Control Unit provides a definite and convenient place for storing tools . . . tools which are pre-set so they can be placed in operation immediately without making machine adjustments.

Another reason is that the Cross Toolometer, an integral part of the Machine Control Unit, provides a standard for the performance of the tools, thereby enabling corrective action to be taken when necessary. The Toolometer dial is set to indicate the number of pieces which a given tool should produce. When the dial has reached that pre-determined figure, the machine automatically shuts down and the tools are changed. At the same time, other tools indicated by the Toolometer as approaching the end of their usefulness are also changed to take full advantage of the machine shut down.

The Cross Machine Control Unit is helping to keep Ford production going and is also assisting greatly in controlling tool life.

Established 1898

THE CROSS CO.

DETROIT 7, MICHIGAN

Special MACHINE TOOLS

Talking Shop . . .

Medical Report

PHYSICAL COORDINATION doesn't get worse with age, as many think. Tests indicate that there is little change from age 18 to 50. Driver tests showed only 0.06-sec difference in reaction time between people aged 23 and those of 65. Also, reduction in ability to learn new things as we get older is much more gradual than commonly thought.

M-50 Number 3

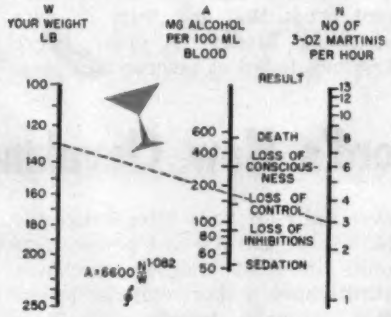
ONE OF THE OLDEST buildings at the Chicago & North Western Railway shop in Chicago is the block-long locomotive repair building, number M-50. This was originally used for repairing steam locomotives, then temporarily for diesels, until it was supplanted by a more modern building. Now it is converted to a freight-car repair building. It is preparing freight cars on assembly-line basis. Interesting in the setup is the fact that this marks revival by the North Western of the cycle repair system—in other words repairing freight cars on a regular basis. Most railroads have not done this for some years —with familiar effects on rolling stock.

Finns on Russia

THERE ARE a number of Russian Pobedas used as taxis in Finland. A delicate indication of the feeling of the Finn toward his big neighbor on the East is the fact that some Finns will stand at a taxi rank and wait until somebody else engages the Pobeda at the head of the line. This is no reflection on the car—a very decided one on its makers.

Hydraulics

PROPERLY PREPARED circuit diagrams of the designs easily accessible for repairs are the major points in reducing downtime in the hydraulic systems of modern transfer machines, according to F L Makin of GM Institute, before the recent meeting of the National Fluid Power Association. He also advocated standardization so repair parts would be more readily available, particularly insofar as mounting plates, tubing and hoses are concerned. He listed as a major cause of trouble broken tubing caused by poor specifications. Pipeline surges caused by rapid stoppage of the fluid by a quick-acting valve is also a source of trouble. Vibration from long runs of piping and improper care of hydraulic fluid are listed as other causes of failures. Modern fire-resistant fluids are not as compatible with seals and packings as are the petroleum-base types, and the new fluids also attack paint and some plating. Piston rods should be R_c 50-60 and have surface finish of at least 20-30 mu-in. to avoid pick up and scoring. Test connections should be provided at many points so they can be isolated without difficulty.



SOBRIETY CHART

Martini Nomograph

ENGINEERS design many nomographs, according to D S Davis of Virginia Polytechnic Institute. He therefore provides the chart shown above to show how many 3-oz martinis taken in one hour will achieve the desired result. Charted is the effect of three on a 130-lb man—complete loss of control, but not loss of consciousness. This is caused by absorption of about 175 milligrams of alcohol per 100 milliliters of blood.

Live Longer With "Don'ts"

FOUR THINGS to avoid if you want to live longer:

Worry—about finances, health, family

Fear—of losses, future trouble, people

Embarrassment—it's tied in with fear

Suffer—physically or mentally

Easy to say; tough to live up to—*Quoted from Dr W H Rice, Armco Steel Corp, at Chicago AISI meeting.*

Douglas English

SOMEONE at Douglas Aircraft Co has just requested annual financial reports from Trans Australia Airlines with the remark that "this would be most valuable to us even though it is not published in English." Somebody should tell 'em that the Australian language is nearer English than is the language we speak, just as the Australian does more flying per capita (white population) than we do.

Apprentice Senators

TWO US SENATORS began their careers as apprentices——one at 4¢ an hr as a machinist apprentice, and one at 9¢ an hr as a plumber apprentice. This and similar facts are included in the 1955 edition of "Apprenticeship Past and Present" issued by the Bureau of Apprenticeship, Department of Labor. Single copies are available for 20¢ from the Superintendent of Documents, Washington 25, D. C.

Manhandled Steel

ONE TON is handled as much as 30 to 40 times during its production, mostly in 10- to 20-ton sizes and lots. Nobody knows how much more handling goes on while it's processed into usable form for the market. Estimate was quoted by Robert S Bogar, Bethlehem Steel Co, speaking on preventive maintenance for cranes. This puts a crimp in the style of those who think their own materials-handling problems are licked.

News of Metalworking . . .

MID-RANGE STRATEGIC PROCUREMENT: The Same

WASHINGTON—Ever since Korea, the traditional skirmishing among the military services for dominance — and budget dollars — has been stepped up to a dizzy pace. The Army, Navy, and Air Force are fighting for shares of an expenditure pie that has risen from a pre-Korea low of under $12 billion yearly to a cold-war level of over $34.5 billion—the highest ever in peacetime.

30-Day War Is the Basis

The jockeying for position by the services has been heightened even more by the recent shift in Defense Dept policy—stressing preparedness for a 30-day nuclear war, rather than dependence on industrial reserves for fighting a war of three years or more—as spelled out in the new "Joint Mid-range Strategic Plan" (*AM*, Dec 5 '55, p107).

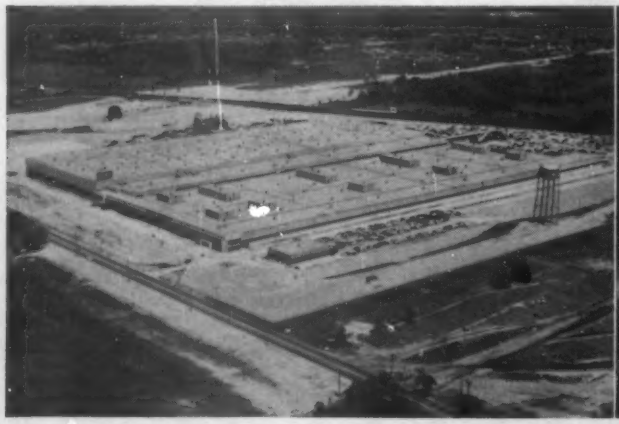
The new policy will have a long-range impact on military hard goods buying. The effect will not be so much on the total volume of procurement, but rather on each service's share of the military dollar and control of new weapons and equipment. For, barring an earthshaking change in the international picture, military spending is likely to remain at the present $34.5-billion level—give or take a billion or so—in the foreseeable future.

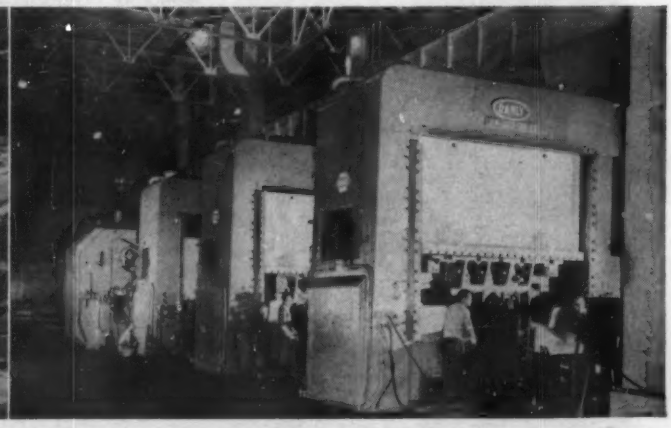
You can trace the new policy to some past and pending decisions:

- The Pentagon has finally shelved the Vance plan for stockpiling reserve tools. About $178 million appropriated by Congress for reserve tool buying will not be spent. The $22 million worth of equipment already ordered for standby lines will be put into current production instead. (The Air Force is about to award contracts for about $50 million worth of machine tools for current production and from its own operating funds; the orders were first negotiated as reserve tool projects and were to be financed out of the Defense Dept's Special Reserve Tool Fund.)
- The Defense Dept is drafting a new policy directive on production equipment. It is expected to allow much freer use of idle military-owned tools now being maintained as "packages" in contractors' plants. Says one official: "The tool packages are not as sacrosanct as one is led to believe." In addition, he alleges that some contractors are probably using idle military equipment for non-defense production — in violation of government policy. Another factor in the upcoming policy change: some of the tool packages are for production of military equipment now considered obsolete.
- This summer, the Air Force awarded special "Phase One" contracts to North American Aviation, Northrop, and Lockheed to design new long-range interceptor planes,

Ford's New Cleveland Stamping Plant—

CLEVELAND—Three new wrinkles in automation were unveiled here at a press opening of Ford Motor Co's new Cleveland Stamping Plant November 29. The innovations: (1) standardization of all automation devices (loaders, extractors and turnover units all have interchangeable parts), (2) use of 2-to-1 power drive units in most transfer machines. (Units have a short cylinder stroke that propels transfer machines mounted on moveable racks twice the distance of the stroke, doubling the speed), and (3) drop-cam electric controls to insure split-second timing (all automation is wired to a press-control circuit so that a single downward sweep of the driver arm sends all units into action at precisely the correct moment). The giant





Autodom's most modern stamping plant . . .
is Ford's claim for its Valton Hills (Cleveland) plant. When an already-under-construction addition is finished sometime early next year, the plant will have 1,549,000-sq-ft of manufacturing space

has 22 major press lines . . .
107 large presses, weighing up to 400 tons, are supplemented by hundreds of smaller presses. They turn out body stampings for Ford, Mercury and Lincoln passenger cars

$34.5-Billion Pie Will Be Cut New Ways

and to Republic Aircraft and North American for fighter-bombers. Purpose is to speed up research and development by eliminating time-consuming preliminary design studies. The special contracts cover preliminary design through mockup.

● The Air Force was allowed to increase production of B-52 bombers and F-101 and F-104 fiighters by as much as 35% to speed up replacement of slower and less formidable aircraft now in operation. The Air Force was also permitted to put the Falcon guided missile into heavy volume production before completing field evaluation tests.

● With the new emphasis on forces in being, the Army was ordered to deactivate 358 reserve companies and to convert 15 undermanned reserve infantry and armored divisions into non-combat units. At the same time, the Army was directed to hold down its equipment reserves to a six-month supply.

● The Defense Dept is revamping its production allocation program—under which about 24,000 plants are now lined up to produce some 4,000 military items in case of full mobilization. Officials seek a means for self-triggering the "phantom orders" —which PAP-planning firms now hold—right after the start of a future war. Right now, it would take about two months after a future M-Day for these orders — which cover specific types and quantities of military equipment—to become effective. In addition, the orders are likely to be screened periodically to weed out ones for obsolete armament or for military goods the short-war strategists consider marginal.

Basically, the fight over the military dollar centers on this issue: what kind of a war are we preparing to fight?

Up to now, mobilization plans have been based on a long war patterned after World War II. This was the essence of the policy of "maintaining a broad base," proposed by Defense Secretary Marshall in 1950 and adopted by both the Truman and Eisenhower administrations.

Rapid advances in nuclear weapons and jet-powered aircraft—and Russian achievements in bringing them into a rough equality with us —has at long last changed all this.

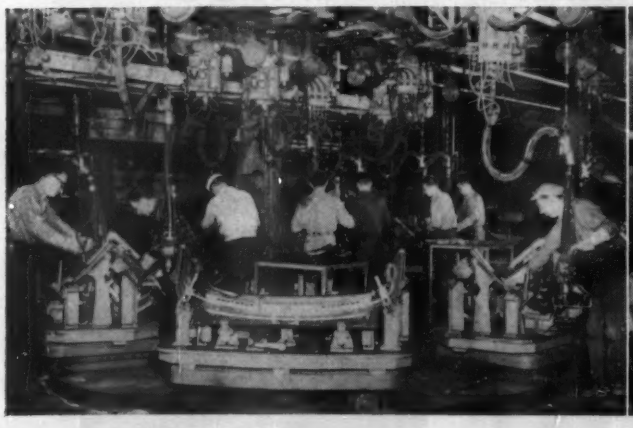
It also overhauled the makeup of the military budget: in fiscal 1956, the Air Force will be top dog with over $15.8-billion expenditures, followed by the Navy's $10 billion. At the bottom of the pile is the Army with about $9.2 billion.

The new strategic plan, of course, does not settle all military issues. For one thing, there is considerable debate over control of the new nuclear weapons and the means of delivering them on to enemy targets. In particular, the Air Force's mission of delivering the strategic weapon is being challenged by the Navy.

(Continued on next page)

a Case History in Standardized Automation

stamping plant, unveiled simultaneously with Ford's No. 2 Cleveland Engine Plant, is situated 14 miles outside Cleveland in Walton Hills, has 1,334,000-sq-ft of manufacturing space, employs 3800. A 215,000-sq-ft addition is already under way, will be finished early next year. The plant has 22 major press lines with 107 large presses, supported by hundreds of smaller presses. Movement of steel sheet through press lines is highly automated, as is materials handling, and welding operations are performed on automated "merry go rounds" to weld stampings from two or more lines together. Huge 30-ton cranes feed steel coils into automatic blankers where steel is cut to size. About 80% of all steel used comes in coils weighing up to 30 tons.



"Merry-go-round" welding . . .
As the stampings revolve, employees weld sub-assemblies in place with batteries of overhead welding guns that hang from monorail conveyors. Nine welding guns are used on the cowl-top unit shown here

. . . and automated conveyor lines
that carry automobile body stampings through such processes as the welding operation. Conveyors and transfer devices link welding operations with the press lines

Field Report USA:

MID-RANGE (continued)

There is even more rivalry over tactical weapons. Many Washington strategists argue that the deterrent value of A-bombs and H-bombs has been weakened by our reluctance to use them in Korea and Vietnam. These officials do not dispute the decisions. They only say this is all part of a U S-Russian nuclear stalemate that emphasizes the role of tactical weapons in future warfare.

The inter-service ruckus is highlighted by individual issues:

- Each of the services now has guided missiles and struggles for control of improved models. The Army considers missiles a push-button outgrowth of field artillery, says it should control land-to-land missiles. The Air Force looks at the new weapon as an item of aircraft.
- The Navy wants a bigger role in delivering strategic weapons. Its new supercarriers are equipped with attack-bombers that can drop H-bombs. Says the Navy: as mobile bases, aircraft carriers can launch planes at most enemy targets and carry out missions more effectively than land-based, long-range bombers.
- The Air Force is peeved at the Army's steady buildup of an aviation arm. Over the past few years, the Army has acquired 3400 helicopters and small fixed-wing planes under its drive to achieve "battlefield flexibility and mobility."

VMC's New Furnace Ups U S Vacuum Metal Supply

SYRACUSE, NY—Supply of vacuum-melted metals will be increased 60 to 75 tons a month by the 2200-lb vacuum furnace just put into operation here by Vacuum Metals Corp. The company is jointly owned by Crucible Steel Co of America and National Research Corp.

The new induction furnace has air locks for charging raw materials and for removing poured ingots to permit continuing operation without breaking the vacuum in the furnace chamber.

Regular price for 52100 bearing metal, air melted, is 20 to 25¢ per lb. The vacuum-melted metal currently runs $2.10 to $2.25 per lb. Rejection rate on instrument bearings has been sharply cut by the new material, however—in one case from 15% to less than 1%, in another from 50% to about 3%.

Industry Will Finance Boom In Capital Goods Buying from Internal Funds

WASHINGTON—Economists are in general agreement that the United States is entering an unprecedented era of industrial expansion. But the question is where will American industry get the money for new plant and equipment? From its own capital? From floating stock and bond issues? Or from outside sources?

95% Internal Financing

The answer seems to be that the lion's share of new plant and equipment will be paid for by industry itself from internal capital funds. That's the contention of Machinery & Allied Products Institute, which has just published the results of intensive research into the subject. Capital funds over the next 10 years will take care of 95% of outlay for new plant and equipment, MAPI finds. That's on the basis of a high rate or retained earnings, but even a low retained earnings estimate shows funds from internal sources will take care of 90% of outlay.

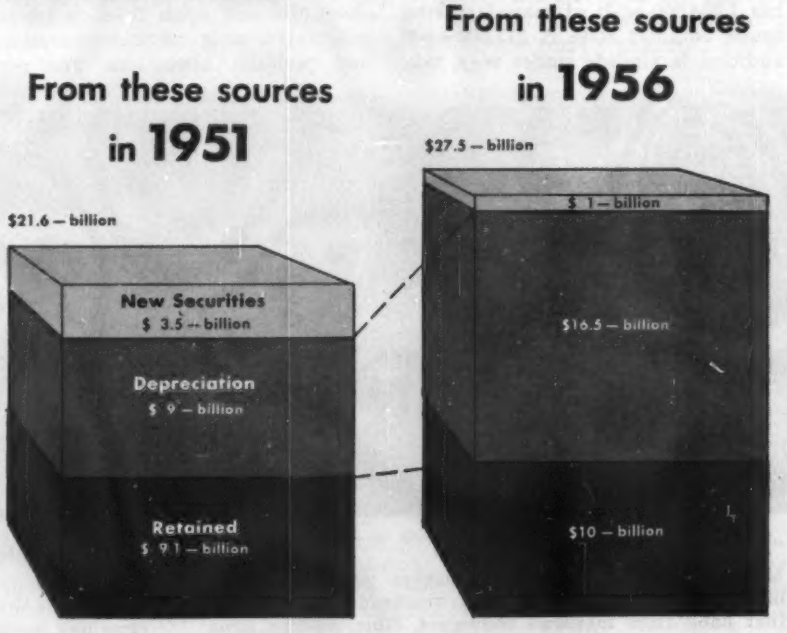
And the remaining 5%, or 10% as the case may be, of money needed to finance capital goods buying can easily be raised by U S industry from security issues, mortgages, bank loans or accrued tax liabilities. In the years 1945-1955, funds from external sources not only offset needs for working-capital expansion, they left a balance of $37 billion for purchase of new plant and equipment—an amount that far exceeds the estimate of $26 billion that will be spent for this purpose in the next decade.

Within the internal financial structure of a company, where will the capital goods money come from? MAPI estimated that depreciation and amortization allowances will probably provide at least two-thirds of the capital needed, while retained corporate earnings will take care of 25 to 30%. External funds can easily take care of the rest.

This is, of course, barring a major depression in the next 10 years, and excluding the possibility of further inflation.

Not only can industry's accrued capital support an increasingly higher level of capital spending in the next decade, it could support much more, Machinery & Allied Products Institute contends.

Where the money comes from



Field Report USA:

Field Report USA:

Forecast for Philadelphia and Vicinity...

BRAINSTORMS

PHILADELPHIA—Philadelphia industry is playing a new game that's netting new ideas, methods and, more important, dollars. It's called "brainstorming." It's a sort of mental freewheeling that brushes the cobwebs out of your firm's best brains. Or you might say it's a way of shifting your mentality into overdrive.

Sound crazy? Minneapolis-Honeywell's Brown Instrument Division doesn't think so. A couple of its men, Research Engineer Steve Higgins and Training Director Larry Scheetz, attended creative thinking courses for executives at Penn State and LaSalle Institute, respectively.

They were so impressed with what can be done with unleashed imagination that they asked Brown Instrument's top management if they could set up a pilot course in Creative Engineering within the company. Sure, go ahead, the bosses said. That was six months ago. The first course is over now, with 14 mentally awakened design engineers graduated cum laude.

The Objectives

Meeting twice a week for six weeks during working hours, Brown's Creative Engineering Course has two objectives:

- To stimulate the flow of ideas and to provide the right atmosphere for creative, imaginative thinking.
- To solve business, technical and personal problems ("the more ideas we generate, the more alternatives we think up, the more likely we will arrive at a satisfactory solution.")

To achieve these objectives, Brown's engineers followed three working principles:

- Groups can produce more and better ideas than individuals working alone. Group free-wheeling or brainstorming develops an amazing flood of workable ideas.
- Each person in the group must participate in all discussions to advance his own thinking and to promote fluency of fellow students.
- Critical analysis or judicial thinking must be excluded or deferred because it hinders the flow of ideas ("all hot water at first—plenty of time for cold water afterwards.")

Or you might say the basic objective of Brown Instrument's Creative Engineering Course boils down to this: get the technical specialist out of his so-close-to-the-forest-he-can't-see-the-trees attitude. Make him get rid of his "this is what you *can* do; this is what you *can't* do" complex.

Is creative thinking or brainstorming new? Not really. It's been going on since the first man said "I've got an idea." What's new is the belief that creative thinking can be taught . . . that anybody can have an idea.

Most experts give credit to Alex Osborn as the modern father of brainstorming. Certainly there's no doubt that Osborn put the principles and techniques into words. His textbook, *Applied Imagination,* is already in use on the campuses of 300 colleges and universities. Numerous executives who learned the technique from Osborn or his teachers are putting brainstorming to practical use in a wide variety of industries every day.

Osborn's technique is based on the fact that anybody can have an idea. What kills ideas is negative thinking. Like the man who says when an idea is presented to him: "I tried that in 1922. It didn't work then and it won't work now" or "For Pete's sake, Jones, why don't you spend your time working instead of trying to be an Edison?"

Remove this idea-killing block, says Osborn, and you open the floodgates of creative imagination. One idea will lead to another and you'll soon find the solution to the problem. And have plenty of workable ideas left over.

How Brainstorming Works

Here's how the technique works:

A group gets together to work out a solution to a problem. Less than 15 people for the best results. Before the brainstorming session, the group agrees that there will be no negative thinking, nobody will try to throw cold water on any idea until the evaluation period.

Next, the problem is written on a blackboard so that everyone can see it during the session. It is clearly defined so that each brainstormer understands the problem. Then the session starts.

Here the technique varies. Some experts brainstorm for 30 minutes or more. Others feel that three minute periods are the best. Whichever system is used, each idea is written on the blackboard as it is suggested so that everyone in the room can see all the ideas at once. This serves two purposes: everyone has the same knowledge as the meeting progresses and each idea usually stimulates one or more other ideas.

At the end of the session either one of two techniques is used: the ideas can be evaluated on the spot or (most experts prefer this one) the ideas are copied, typed up and circulated to the participants and evaluation is delayed for several days. This method allows time for each member to come up with additional ideas. Finally, the solution is decided upon . . . either by the group or the executive in charge.

A Practical Example

Here's a practical, concrete example of brainstorming that came out of a freewheeling think session of executives from several industries at one of American Management Association's Communications Courses:

The problem: what methods can be developed to best utilize the older man in industry?

This question will naturally evolve into two categories. The first, how can a man be of greatest service to the company in the last five years before retirement? The second, what can the company do to prepare him for retirement? This is a serious problem faced by every company. When a man reaches his sixties, he starts to worry about what's going to happen to him, and often his use to the company falls off rapidly. He's got to feel useful, and he must be prepared psychologically for retirement.

Here's what AMA's brainstormers came up with in the way of suggestions as to how he can best be of service to the company:

- Have him train younger men.
- Let him orient new employees.
- Make him a sort of good-will ambassador to new employees and between the company and the public.

(Continued on next page)

- Put him on a consulting basis after retirement.
- Use his ideas based on experience.
- Have him help in long-range plans.
- Keep him active on committee work.
- Have him (1) analyze company policy in the light of his experience, (2) write training manuals, and (3) analyze company methods and make suggestions for improvement.
- Give him a new, higher position and title (such as making a superintendent Director of Training).
- Give him challenging assignments outside the normal scope of his work.

The company can do these things to prepare men for retirement:

- Put him in touch with retired employees or those about to retire—form an older employees club.
- Give him hobby training—let the company send him to oil painting, woodworking, ceramics classes in the evenings, for example.
- Set up a library of books on "growing old gracefully."
- Ease him into retirement gradually by having him work half a day.
- Help him plan a financial after-retirement program based on a lower income.
- *Above all, get his wife into the picture.* His retirement is going to make a radical change in her life, too. Call her in and talk over financial and what-do-with-so-much spare time plans with both of them. Make them both feel that they're still a part of your organization even after retirement. It must be remembered that today's retirees and their wives come from a generation that until recently expected a man to work until he dropped in his tracks. These are problems that will occur in every company to more and more people with increasing frequency from here on out.

East...

Eastern briefs . . .

Four-day **Plant Maintenance & Engineering Show** plans to exhibit more than 5000 different pieces of equipment in Philadelphia's Convention Hall January 23-26 . . . **Olin Mathieson's** Western Roll Bond has a new name, Olin Roll-Bond . . . **Landis Machine Co,** Waynesboro, Pa, is putting up an 11,250-sq-ft addition to its Tap Division building to house its Research and Thread Roll Die Depts . . . **Clegg Laboratories,** Morristown, N J, is expanding its model shop and its electronics and microwave equipment manufacturing facilities . . . **Houdaille Industries Inc** is the new name of the 26-year-old **Houdaille-Hershey Corp,** Buffalo . . . New York City high schools are looking for engineers and technicians to teach shop classes. Minimum requirements are 4 years of engineering and three years' experience. Salaries run up to $7200 . . . **American Bantam Car Co,** Butler, Pa, is being bought out by **Frederick W Richmond & Associates,** New York, and will be merged with **Pressed Metals of America Inc,** which has plants in Port Huron and Detroit, Mich . . . **American Silver Co,** Flushing, N Y, is offering $1000 for the best new applications of thin gage and/or high-precision tolerance stainless steel strip. Contest closes next May 30 . . . **Conoflow Corp,** Philadelphia, will become a subsidiary of the **Walworth Company,** New York valve and fittings maker, January 3 . . . **Black & Decker Mfg Co** will build a $3.5-million addition to its electric tool plant at Hampstead, Md. It'll be ready next October.

Midwest...

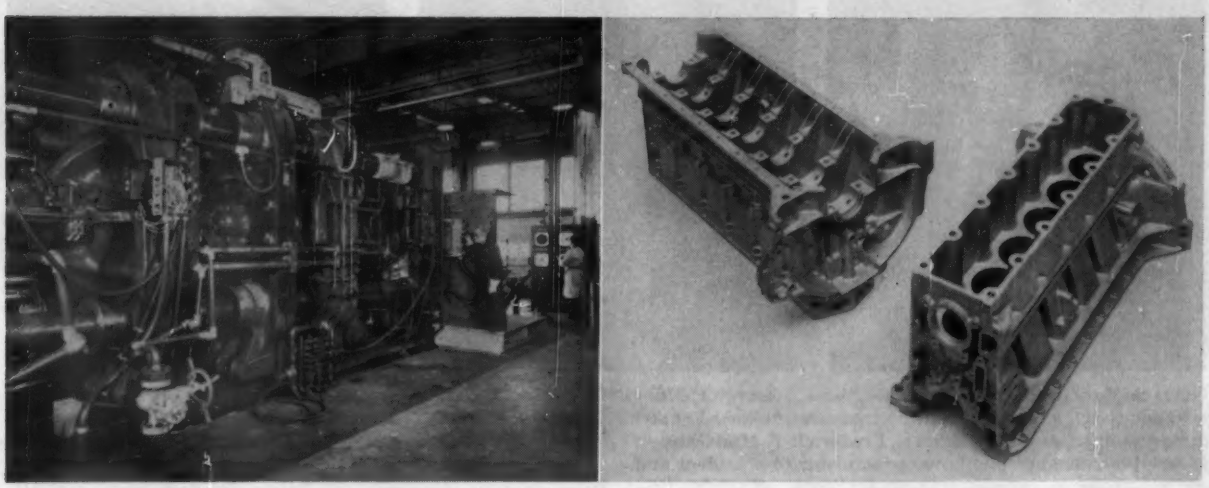
Around the Midwest . . .

Republic Steel's president says if raw materials prices go up, steel prices will rise to cover. Right now, Republic says it's running pretty close to the bone, with too small a profit margin to allow for plowback into expansion . . . Looks like **Mullins Mfg Corp** (Koldflo process) will become the **Youngstown** (Ohio) **Kitchen Division** of **American Radiator & Standard Sanitary Corp** . . . **GM** says there's been too little change in U S cost of living this year to require any adjustment in cost of living allowances for its 433,000 hourly rated employees during the next three months . . . **Granite City** (Ill) **Steel Co** will build a 1200-tons-of-pig-iron-per-day blast furnace . . . **Ford's Aircraft Engine Division** has taken over operation of 18 jet engine test cells at **GM's Fisher Body** plant, LaGrange, Ill. . . . **Timken Roller Bearing Co** will spend $5 million to expand its Columbus, Ohio, bearing plant . . . **Thor Power Tool Co,** Aurora, Ill, has bought out **Cincinnati Rubber Mfg Co,** makers of conveyor belting, packings and gaskets . . . In spite of a 9-week strike, Cleveland's **Eaton Mfg Co** expects record net sales of $215 million for 1955 . . . **Anderson Brass Co,** Detroit, is buying some assets of **Detroit Brass & Malleable Co,** will make them the nucleus of a new subsidiary, **Detroit Valve Co.** Detroit Valve will be in production at the DB & M Brass Division plant by the end of this month . . . **Kling Bros Engineering Works,** Chicago manufacturer of metalworking machines, has expanded its distributor organization into 30 cities in the U S and Canada . . . Chicago's **Borg-Warner Corp** has acquired **Primor Products Inc,** Adrian, Mich, maker of refrigerator units for air conditioners . . . **Oster Mfg Co,** makers of pipe and bolt threading machinery, is moving into a new 105,000-sq-ft plant in Wickliffe, Ohio . . . **Diebold Inc** has settled with the AFL for a 16¢ an hour increase now, and an automatic increase of 8¢ an hour in 1956 and another in 1957 for its 850 employees in Canton and Malvern, Ohio . . . **Polis Mfg Co,** Chicago, has bought out **Blair Pin Bolt Co,** Chicago and Los Angeles . . . **Outboard, Marine and Mfg Co,** Waukegan, Ill, makers of Johnson and Evinrude outboards, plan a five-year, $12-13-million expansion program, including at least one new plant . . . **American Auto Parts Co,** Kansas City, Mo, has made a top sealed bid of $2.2 million for the government-owned Gary, Ind, armor plate plant.

South...

Southern newsbriefs . . .

Ford Motor Co, Atlanta, ran into trouble over workgloves. Under a contract with UAW-CIO Ford is supposed to provide gloves for workers when it's established that their work would be unsafe without them. Seems that Ford failed to do so in some cases and the UAW local filed grievances, threatening to strike just before the Christmas season . . . **GM** is busy squelching rumors that it will build a 2½-million-sq-ft Buick assembly plant in Miami. Tain't so, says GM, a Miami-area plant of that size would mean a big loss to GM because there's no place to ship the finished cars . . . **Lockheed Marietta** is operating at peak, turning out upwards of 50 aircraft a day, with a payroll of 20,000. Lockheed is also transferring in one of its top nuclear engineers from the West Coast—could mean nuclear development work at Marietta.



Doehler-Jarvis Die Casts 6-Cylinder Aluminum Engine Block

TOLEDO: World's first die-cast aluminum engine blocks are being produced on an experimental basis at Doehler-Jarvis Division, National Lead Co, here. The straight 6-cylinder blocks come out of the die casting machine (left) weighing about 50 lbs, are machined down to 47 lbs (right) —the largest aluminum die castings ever made. The same block in gray iron would weigh 175 lbs. On a production basis, the aluminum blocks will cost 10% less than gray iron. They can be produced at a rate of 30 to 35 an hour on the machine at left.

West . . .

Los Angeles area briefs . . .

Axelson Mfg Co, division of U S Industries, is starting work on a $1-million-plus expansion of its aircraft components manufacturing facility at Montebello. The 120,000-sq-ft expansion will release space at Axelson's Vernon, Calif, headquarters for machine tool production . . . **Electro-Aire Inc,** maker of fraction hp motors for aircraft, has become an operating division of **Hydro-Aire Inc.** It's been a Hydro-Aire subsidiary since 1951 . . . **Garret Corp's** new **Rex Division** is at work on a hush-hush project that "will be very advantageous for the military and will have good commercial use as well" . . . **Lockheed** recently tallied up the 16-year history of its Constellation, came up with this: Lockheed has sold $1.248 billion worth of them in all versions, it's kept 5000 people working on an average since 1940, and current Connie backlog is $202 million . . . **Western Gear Works** has broken ground for a $250,000 engineering building next to its Lynwood plant. The 20,000-sq-ft facility will be ready in May 1956, will have work space for 200 engineers . . . **Standard Steel Corp** has a $400,000 contract from **North American Aviation's** new Rocketdyne Division to make stainless pressure vessels to hold rocket fuels . . . Los Angeles Chamber of Commerce has formed an Industrial Plant Location Committee to nose out locations that are out of the smog-critical areas of Los Angeles, but still in or near the city . . . **Hetherington Inc,** makers of aviation switches and indicators, has moved its West Coast Division from Culver City to 139 Illinois Ave, El Segundo . . . **Fluor Corp,** Los Angeles, has abandoned previously announced plans to form a Canadian pipe-making affiliate. Reason: it can't get enough steel up there . . . **Hughes Aircraft Co** is going into the industry market for electronics equipment, will sell the electronics products created through its research activities through a newly created **Hughes Products Division,** headquartering at 5330 W Century Blvd, Los Angeles . . . LA Chamber of Commerce reports there are 436 electronics manufacturers in metropolitan Los Angeles, doing an annual factory billing of $916,680,000, and employing 72,167.

San Francisco area . . .

California shipbuilders have asked the government to award Navy and Maritime new ship construction contracts on a regional basis. This, they say, would pull the West Coast out of the distressed category and keep it healthy in case of war . . . **Pacific Trailer Ships Inc** has petitioned the state for permission to operate two "piggyback" ships that could carry 288 35-ft truck trailers between San Francisco and Los Angeles. They'll take 18 months to build, will cost $9.5 million each.

Elsewhere in the West . . .

Boeing Airplane Co, Seattle, reports first nine months' sales this year are down to $588,716,721 from $771,511,-226 last year. Net earnings dropped from $27,199,384 in the first nine months of last year to $20,333,185 this year. Boeing's backlog stands at $1.9 billion . . . Denver's **B K Sweeney Co,** tool manufacturers, is negotiating for 14 acres of land as a site for a 50,000-sq-ft manufacturing building, to cost upwards of $2 million . . . **Glenn L Martin** will build a 500,000-sq-ft guided missile and aircraft product plant on a 5000-acre tract 15 miles south of Denver. It's slated for completion within 15 months . . . **Goodyear Aircraft Corp,** Litchfield Park, Ariz, is retooling and rebuilding its workforce to handle a multi-million-dollar contract for construction of B-52 components such as wing sections, fuel decks and panels. Boeing Seattle will provide fixtures and jigs . . . **AiResearch Mfg Co,** Phoenix, has been awarded a $5,293,038 Air Force contract for pneumatic starters for turbojets.

Niagara Machine & Tool Works elections . . **George E Munschauer** (left), vice president and treasurer, to board chairman and chief executive officer; **Frederick E Munschauer, Jr** (center), vice president, manufacturing, to president and general manager, succeeding his father, the late **Frederick E Munschauer; Franklin A Reed** (right), sales manager, to vice president, sales; and **Edwin A Munschauer, Jr** (below), service manager, to treasurer

Names in the News . . .

R W Johnson and **Irving C Maust** have been named vice presidents of Foote Brothers Gear & Machine Corp, Chicago. Mr Johnson is director of sales for the industrial gear division, Mr Maust for the precision gear division.

Borg-Warner Corp promotions . . **M R McLary,** works manager of Ingersoll Products Div, to divisional vice president; **Robert F Schutz,** from manager to vice president and manager of Ingersoll Kalamazoo Div.

Crucible Steel Co of America elects . . **James D Glenn,** general sales manager, to vice president, sales, and **Maurice J Day,** director of research and development, to vice president, research and development.

Robert E Sanford, formerly forging consultant for Clearing Machine Corp, has been appointed design engineer for Erie Foundry Co, Erie, Pa.

Paul R Minich, Jr, formerly a Yale representative as president of Materials Handling Products Corp, has been named general sales manager of Yale & Towne Manufacturing Co's Materials Handling Div. **Joseph J Murray,** Yale sales department executive, has been appointed assistant general sales manager.

Harold E Kingsbury, resident engineer at Chrysler Corp's west coast operations at the Los Angeles plant, has been named chief engineer.

E E Boberg, vice president, sales, of the Standard Conveyor Co, North St Paul, Minn, has been elected president of the Conveyor Equipment Manufacturers Association. He succeeds **Jervis C Webb,** president and general manager of Jervis B Webb Co, Detroit.

G S Crane (left), president and chief executive officer of Cutler-Hammer, Inc, has been elected chairman of the board and of the plans committee. He succeeds **H F Vogt,** who has resigned as chairman, but will continue to serve on the board. **Philip Ryan,** executive vice president, and vice president, manufacturing and development engineering, succeeds Mr Crane as president

Anderson Ashburn, formerly special products editor of *American Machinist,* and associated with the magazine since 1942, has been appointed managing editor

Kearney & Trecker Corp appointments . . **Andrew K Wilson** (left), director of industrial relations, to vice president, industrial relations; **Morris L Hutchens,** chief engineer of special machinery, to chief engineer of the company

New Norton Sales Managers . . . Four sales managers appointed by Norton Co . . **Donald L Price** (upper left), grinding wheels; **George A Park** (upper right), abrasives; **Harlan T Pierpont** (lower left), refractories; and **Fred L Curtis** (lower right), new products

John N VanEpps, formerly manager of contract sales for Universal Winding Co, has been appointed vice president of manufacturing for Madison Manufacturing Co, Muskegon, Mich, and Madison Industries, Big Rapids, Mich, affiliated companies. **Willard F Bierman,** chief engineer of Madison Manufacturing, has been named sales and engineering manager of Madison Industries.

George R Milne, vice president, operations, has been appointed president of the National Carbide Co, a Division of Air Reduction Co. **Russell T Lund,** vice president, succeeds Mr Milne.

Eugene P Hawkins has been elected vice president of Revere Copper & Brass Inc, and appointed executive head of the company's Michigan Div. He had been assistant general manager of the division. Mr Hawkins succeeds **Harold N Todt,** who has retired as vice president.

Carl C Kamphausen has been elected executive vice president of Allied Products Corp, Detroit. Associated with the company for 20 years, Mr Kamphausen will be in charge of metal parts production operations.

John F Crowell has been appointed sales manager of the Centra-Point Division of William H Field Co, Boston. The division has been formed to manufacture the company's new end mill grinder.

C C Erickson, sales manager of Stillman Rubber Co, Culver City, Calif, has been named executive vice president.

William K Downey, assistant to the president of Skil Corp, Chicago manufacturer of power tools, has been appointed vice president, sales.

George E Smith, sales engineer, has been named manager of the Mid-Atlantic District of Kennametal Inc's Metalworking Div.

D Frank Mederos has been elected vice president and assistant to the president of the Walworth Co. He will continue direction of the company's eastern division, and Boston branch sales.

OBITUARIES

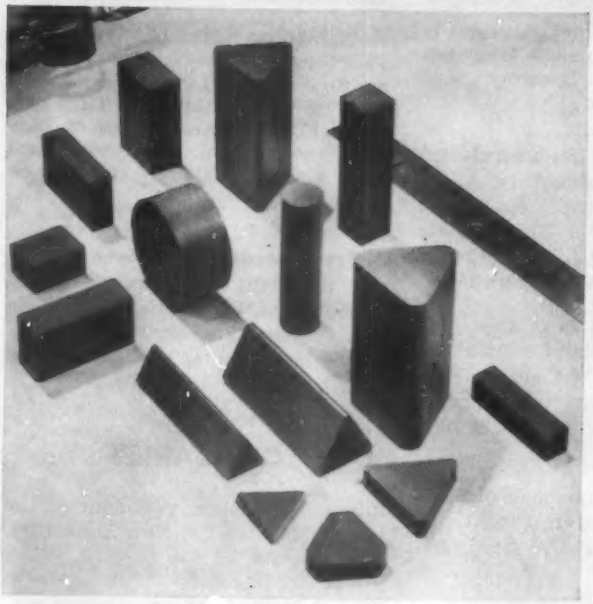
Ray F Steinhauer, president of the Heller Machine Co, New York City, died Nov 22.

George Gorton, Sr, 90, pioneer machine tool designer, and president of Gorton Machine Co, died at his home in Racine, Wis, Nov 22. Mr Gorton, who made daily trips to the office until shortly before his death, founded the company 67 years ago. Among the many machines which he designed and built are the Gorton pantograph, the first automatic wrapper, and a Swiss-type screw machine widely used during World War II.

Arthur E North (left), secretary and treasurer of The Bullard Co, is retiring from that post, and as a director of the company Dec 27. He joined the organization as controller in 1918. **Francis L Dabney,** assistant secretary and assistant treasurer, and a director, succeeds Mr North

New Shop Equipment

Carborundum Develops Cemented-Oxide Toolbits

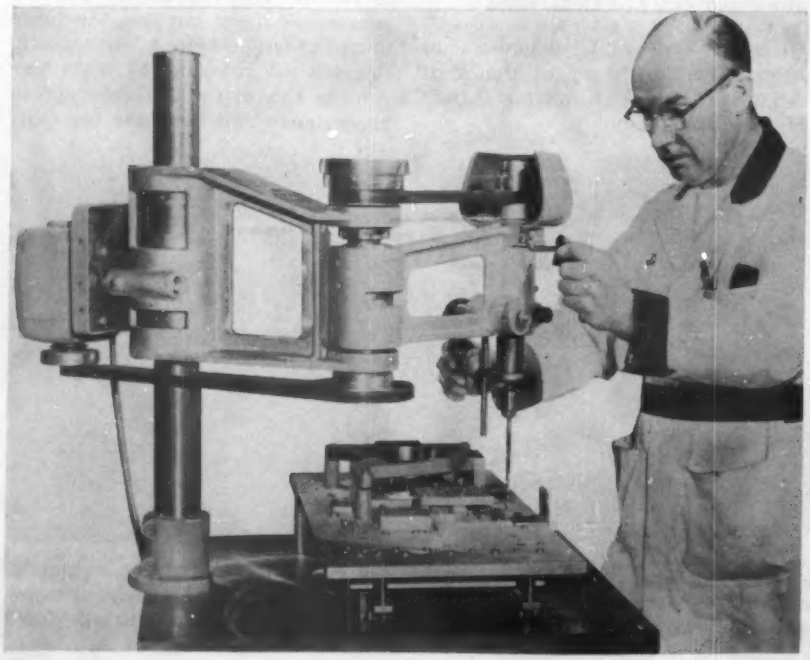


Stupalox, an oxide-base cutting material, will be available in commercial quantities Jan. 1. It is a result of research since 1935 and replaces another ceramic cutting material field-tested earlier this year. Tests indicate cutting speeds up to 10 times those of familiar materials and 4 times the usual length of cut. Tests have been difficult because machine tools with ample rigidity and horsepower have not been available.

On HSS 207-B annealed, HSS tools cut at 80 to 100 sfpm, while the new material gave 505 sfpm with 0.023-ipr feed and 0.125-in. depth of cut. Speed was limited by the machine. On SAE 1035, WC tools cut at 250 to 350 sfpm, while the new material cut at 1175, with feed of 0.015-0.005 ipr and depth of cut 0.005 to 0.250 in. Nimonic 80-A (called "unmachinable"), was cut with TiC at 80 sfpm, 0.005 ipr, and 0.005-in. depth of cut. Tool sharpening was necessary every ¼ lineal in. of cut. With the oxide tool, speed was reduced to 40 sfpm, feed kept at 0.005 ipr and depth of cut increased to 0.100 in. A 3-ft length was machined in 4 min without tool change, compared to 40 min with the TiC.

The material cuts without buildup or cratering, and does not generate as high a heat as metallic tools. Finish is also better. Hardness is 91-95 R_A, compressive strength 400,000 psi, tensile 38,000 psi, Young's Modulus 45,000,000. Specific gravity is 3.85-3.99gm/cc, thermal conductivity 18 Btu/hr/°F/sq ft/ft. It is ground with diamond wheels while mechanically held, requires a special toolholder for maximum production.

Stupakoff Div, The Carborundum Co, Latrobe, Pa



Hill Radial Drill Has Jointed Arm

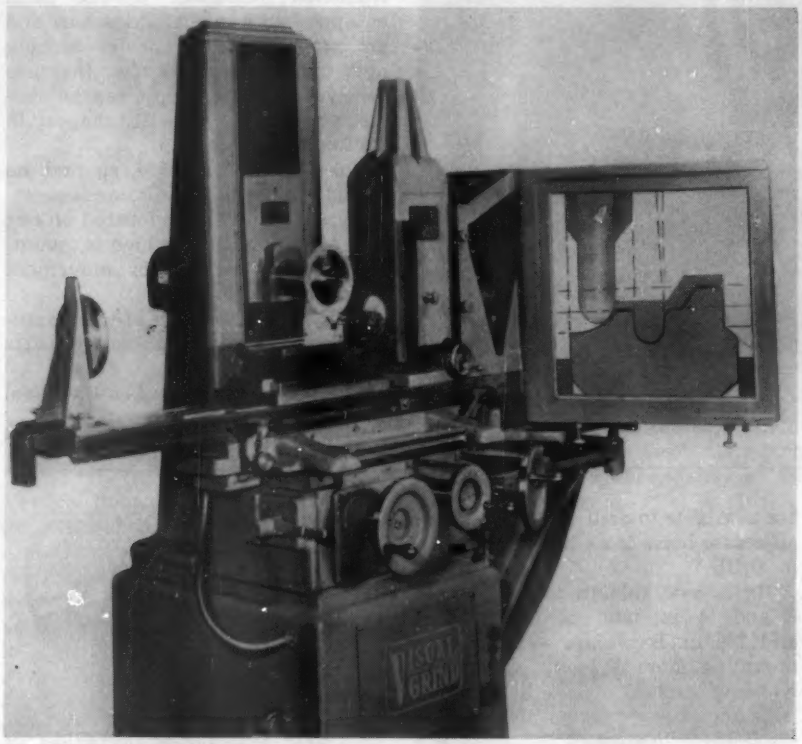
Small jointed-arm radial drillpress is shown machining a complex aluminum-alloy aircraft part into which 119 holes, ranging in size from No. 50 to ¼ in., were to be drilled from the top, bottom, and one end. 105 of the holes were tapped, the threads ranging from No. 2-56 to ¼ in.-20.

Three jigs were used for operation; in this arrangement, work was moved only 3 times.

Machine provides a choice of 6 spindle speeds ranging from 620 to 12,000 rpm from a 3600-rpm, 1/3-hp motor. Overall height of machine is 30 in., diameter of spindle is 1¾ in., travel of spindle is 2½ in., and radial range from spindle center to column is 24 in. Machine can be built to fit individual needs.

Hill Machine Co, 1301 Eddy Ave, Rockford, Ill

Materials and Parts . . .



Cleveland Surface Form-Grinder Has Built-In Optical System

Visual-Grind is designation for projection grinding machine incorporating precision optical system which permits continuous inspection of work during operation. 18 x 18-in. screen is situated to operator's right as he faces controls. Machine is recommended for form-grinding of steel and tungsten-carbide parts. Six lens magnifications ranging from 10:1 to 100:1 are provided.

Machine has automatic table traverse, variable stroke and speed, and one-shot Bijur lubrication system. Work table slides along ways 8 in. wide and 51 in. long.

Specifications: capacity, 6 x 14 x 8 in. high; working surface, 6 x 18 in.; floor space, 50 x 111 in.; weight, 2500 lb.

Cleveland Grinding Machine Co, 1643 Eddy Rd, Cleveland 12, Ohio

Skiving and Shaving Tools

Smith skiving tool bolts on toolpost, skives under or over work, depending on way spindle is running. Tool is available in all sizes from #00 through #6, up to 2⅜-in. diameter capacity. Cutting block can be removed for grinding without disturbing holder.

Shaving tool, used as blade shaver or for contours, is adaptable for single or multi-spindle machine, or any machine that uses circular tools. Tool is available in all sizes from No. 00 through No. 6, up to 2⅜-in. diameter.

Smith Tool Co, 10107 Meech Ave, Cleveland, Ohio

. . . including

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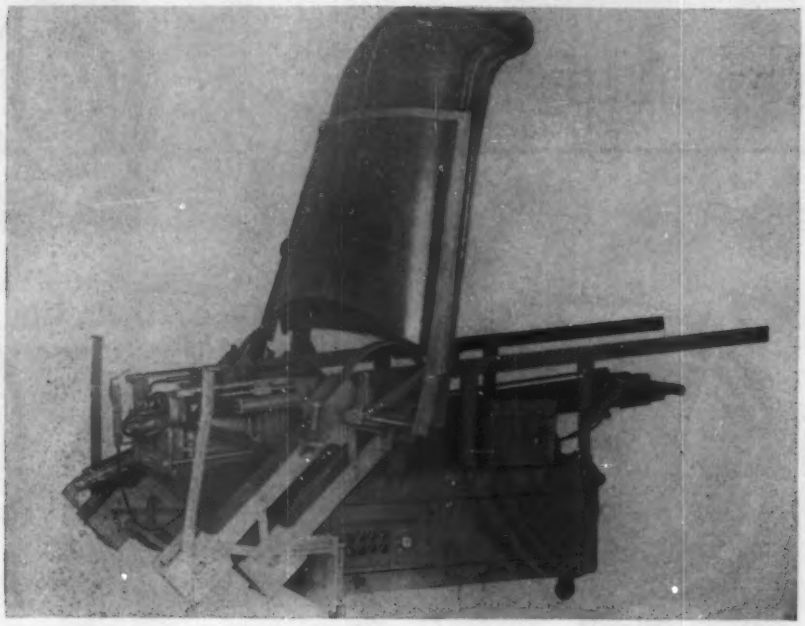
Hamilton Press Feed Has Turnover Unit



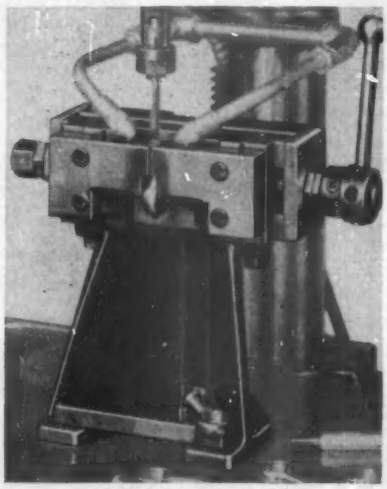
Unit designed to feed heavy metal stampings to a trimming die receives stamped panel, turns it over, then automatically feeds it into the trimming die. Feed stroke of portable unit is 84 in.

Machine is basically the standard Hamilton automatic shuttle hand equipped with special index bars and an integral attachment for turning over metal stampings after they are received. Turnover unit can be constructed to fit special shapes in stamped panels.

110-v current is used, so that no special electrical installation is necessary. All controls are located on one side of the machine, which is mounted on steel casters for movement from press to press.

Unit is one of seven in the Hamilton line of automatic pressroom parts handling equipment.

Hamilton Automation Inc, Hamilton, Ohio



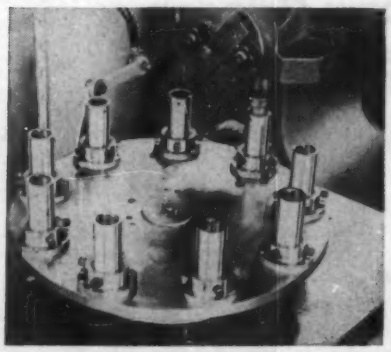
Work-Holding Device Self-Centers Automatically

John's Drill Jig has two moving master jaws that work on a right and left hand Acme thread, allowing them to come to the same distance from center each time. Self-centering action will reportedly hold within 0.0015 in. or better.

Device provides a common base with quick clamping means for combinations of drill jigs for a variety of operations. It is said to be particularly adaptable for precision cross or end drilling of round, hexagon, or square stock, standard or odd-shaped smooth or rough castings from ⅛ to 8 in. OD. Standard removable slip fit bushing and holders are available to drill center or mean-off-center holes from No. 60 to 1 1/32-in. drill.

Jig is available in three sizes, 6, 8, and 14 in.; jaw openings, 2, 4¼, and 7½ in. Bases are available for mounting from 1 to 18 in. off the working surface.

Heuser Manufacturing Co, 1638 N Paulina St, Chicago 22, Ill



Rotary Feed Table For Heavy-Duty Service

All-steel table, either mechanically or air-operated, has index gear made of Meehanite casting.

Outside diameter of standard size table is 15 in.; can be supplied in any diameter from 12 to 36 in. Over-all height, less dial plate, is 1¾ in. with standard index of 12 to 24 stations. Index gear diameter is 6½ in. by 1⅜ in. thick.

Bal-Aero Products Co, 4439 Santa Fe Ave, Los Angeles 58, Calif

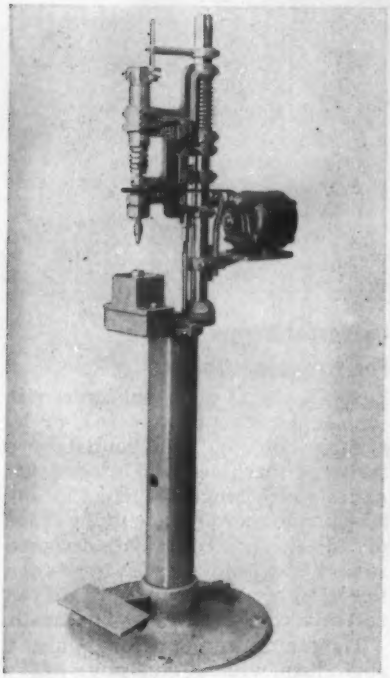
Sump Cleaning Machine Is Mobile Unit

Model 20T-NAW will remove from machine tool sump all fine chips, sludge, and waste coolant by vacuum. By changing settings, coolant can be filtered and returned to machine tool. Up to 200 gal. of waste coolant can be pumped into the storage tank for removal to disposal area.

Machine is equipped with fully automatic fill controls, including vacuum and pressure gages and release valves, as well as a built-in system for discharging coolant from the tank.

Machine has heavy-duty wheel arrangement which allows it to be towed by plant tow trucks and tractors.

Coolant Equipment Corp, Verona, Wis

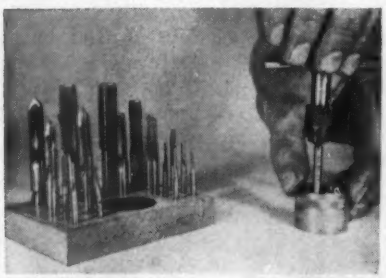


Airflex Spin-Impact Riveter Available in New Model

Vertical floor unit, designated Economy Model, is designed to do general riveting to a maximum of ¼-in. fasteners, based on solid mild steel. Either hollow or solid rivets may be used, however, with capacities larger in aluminum and soft tubular rivets. Parts requiring a 7-in. max throat and a 2⅝-in. max gap are easily accommodated. Model is manual, with foot pedal or hand lever optional.

Unit is priced at $575, less electrical equipment, belt, and muffler.

Lemert Engineering Co, PO Box 282, Plymouth, Ind

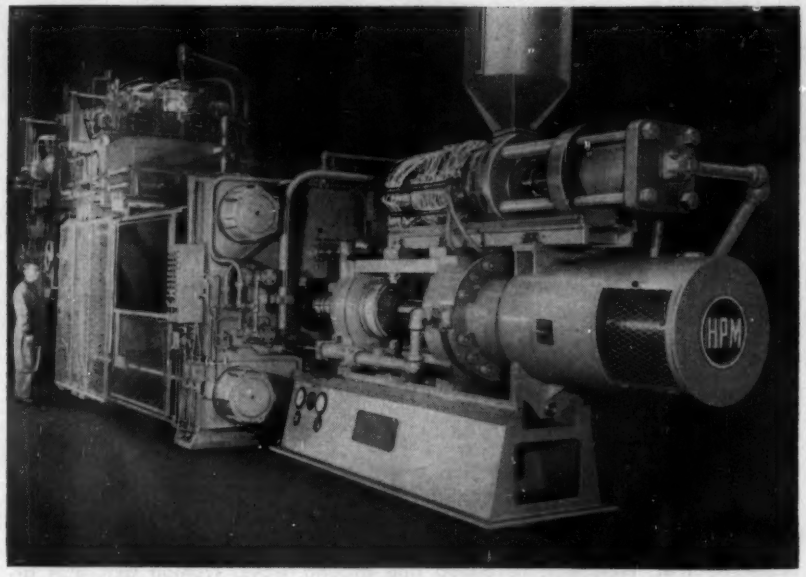


Tap Guide

Taprite tool guides a hand tap straight into hole; it is said to insure easier tapping with less breakage.

Unit, with hard-wood holding block, handles all sizes of taps from smallest up to ½ in., excluding 7/16. Holder accommodates all NS and NF taps and tap guide itself.

Griffith Tool Co, 837 E Crescent, Elmhurst, Ill



PLASTICS INJECTION MOLDING MACHINE, reportedly the largest ever built, has 3000-ton clamp pressure and 400-ounce capacity. Machine completes a dry cycle in 22 seconds. Special machine is designed to mold commonly used virgin thermo-plastics such as polystyrene, cellulose acetate, cellulose acetate butyrate, and acrylics. Features include high injection speed of 400 ounces in 6 seconds, positive "shot" measuring device, and pre-plasticizing chamber which plasticizes independently of the machine cycle — *Hydraulic Press Mfg Co, Mount Gilead, Ohio*

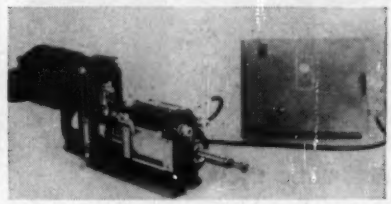
SPECIAL 36-SPINDLE DRILLHEAD built by Thriftmaster is a complete unit including drill bushing plate, index table, and fixtures. Unit is used for drilling, reaming, and counterboring two dissimilar parts at the same time. 4-station index table is manually operated, with 3 stations used for machining and the fourth for loading and unloading. All spindles have vertical and depth adjustment and each spindle is operated at the desired speed — *Thriftmaster Products Corp, 1016 N Plum St, Lancaster, Pa*

Air-Operated Vacuum Cleaner

Glasby Vac-U-Max, operated by compressed air, is said to develop more than twice the suction of a standard 1-hp electric unit equivalent in size.

Portable, rubber-wheeled unit has 20-gal. capacity, is 33 in. high, 24-in. in dia. High suction permits cleaning machinery, equipment, or any surface, or hard-to-move or difficult-to-reach deposits. May be used for wet or dry pickup.

Distributed by American Balmes Corp, 859 Summer Ave, Newark 4, NJ



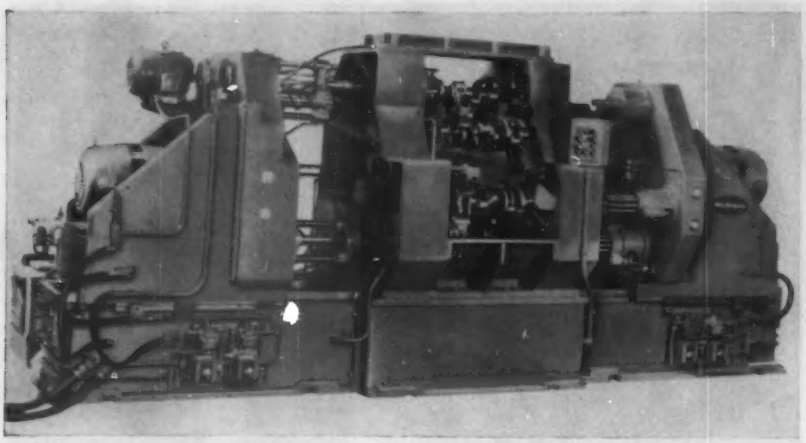
Holomatic Unit Taps and Drills With Automatic Reversing Control

Standard Model 24 Holomatic unit, used with the F268C automatic reversing control unit as a control system, can be used for either high-production tapping or drilling. Three-position selector switch on the cover sets operation desired.

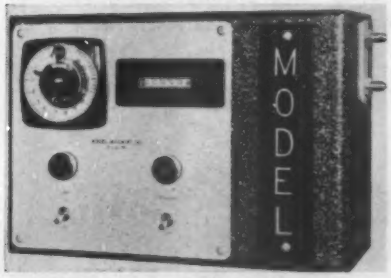
When tapping, reversing of the motor is automatically coordinated with retraction of spindle through an air monitor line connected between control panel and Holomatic. This control system is said to simplify installation and permit standardization of setup procedures for both operations.

Tapping capacity is ¾-16 in mild steel, drilling is ⅝ in. in similar material. Production rates of up to 30 tapped holes per minute can be obtained when special high-reversal-type motors are used for Holomatic spindle drive. Standard open-frame, low-speed motors can be used for tapping up to 5 holes per minute.

Hause Engineering, Montpelier, Ohio



CRANKSHAFTS FOR V-8 ENGINES are processed on Michigan Drill Head's double-end trunion-type machine, which has pot-type heads for easy replacement. Machine drills, chamfers, finish reams, form seats, and taps both ends of the crankshaft at rate of 100 pieces per hour. Machine is built up from standard floor-type feed units with hardened and ground ways. Trunion fixture is arranged with power-operated shot pins, for positive location prior to machining operations — *Michigan Drill Head Co, PO Box 4643, Detroit 34, Mich*

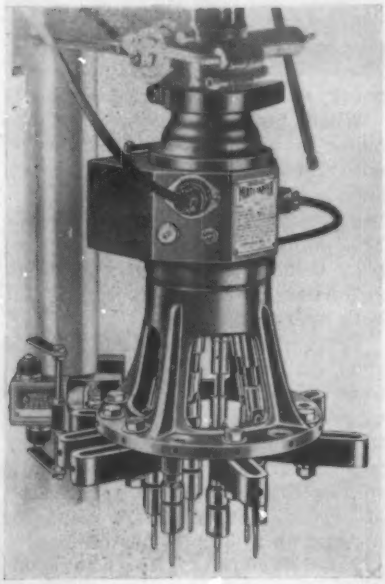


Automatic Cycle Timer

Unit, adaptable to any air-operated equipment, can be set to supply a quantity of air for a predetermined time interval ranging from ¼ sec to 60 hr, depending on model selected. Time cycle is constant, regardless of air pressure used.

Auxiliary circuit for electrically triggering any outside unit which may be used in conjunction with the air equipment is included. Manually reset digital counter for maintaining a constant check on production, and a 3-way valve with ¼-in. outlets are contained in the unit.

Model Machine Co, 4729 Hawthorne St, Philadelphia 24, Penna



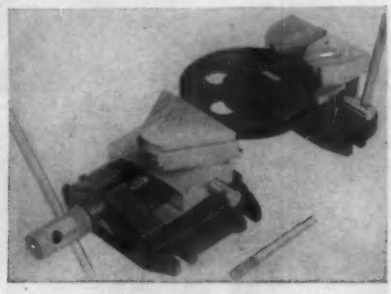
Multiple-Spindle Tapping Head Taps Eight Holes at Once

Universally adjustable Multi-Tapper, made to fit any drillpress, can tap up to eight holes in any pattern with taps of different pitch.

Unit incorporates an electrically controlled, automatically reversing spring clutch drive through which a single drillpress spindle can drive from two to eight taps in automatic or semi-automatic cycles. Only two adjustments are necessary for setup —setting lower and upper stop limits to desired depth. Unit may be used in cycle operations with air or hand feed.

Model 90 has eight spindles with 9-in.-dia tapping area. Model 50 has six spindles, 5-in.-dia area. Tap capacity on both is ¼ in.

Commander Mfg Co, 4225 W Kinzie St, Chicago, Ill



Universal Screw Vise For Irregular Objects

Sevo III vise is universal screw vise for clamping round, tapered, or irregular objects. Jaws consist of a series of machined and ground flat plates which hinge or swivel in any direction to coordinate with the shape of the held object. Jaws are designed so that they can be moved in relation to each other, and the workpiece can rest on a contact surface underneath.

Tightening screw needs only a slight turn, without imposing a heavy torque, to grip the object tightly. Two-part construction of vise makes it suitable for holding large objects.

De Wilde-Jones Inc, PO Box 231, San Francisco 1, Calif

Concentrated Liquid Brightener For Cyanide Cadmium Plating

Highly concentrated Cadmax for barrel and still plating is said to be the first brightener to contain pure chemical compounds of known structure, eliminating breakdown products and organic impurities. Low-foaming product will reportedly produce clear, brilliant, blue-white deposits over an extremely wide range.

Other features claimed: burning is prevented, even with low cadmium metal content in the bath; permits use of high throwing power baths without restricting plating range; optimum results with baths of very low nickel content.

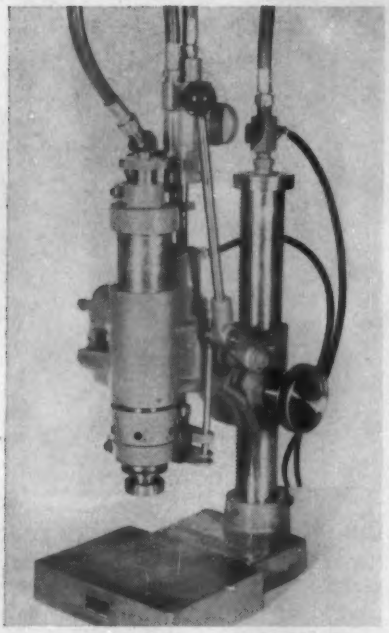
American Smelting & Refining Co, Federated Metals Div, 120 Broadway, New York 5, NY

Sabre-Type Power Saw

Model 305 saw is portable power tool for variety of uses. Blade has ⅝-in. stroke, and motor delivers 2650 strokes per minute under load. Tool is powered by 115v, ac/dc, 1.8-amp motor.

Saw is 6¾ in. long, 5 in. high (less blade) and has shipping weight of 4½ lb. Retail price is $29.95.

Wen Products, Inc, 5808 Northwest Hwy, Chicago 31, Ill

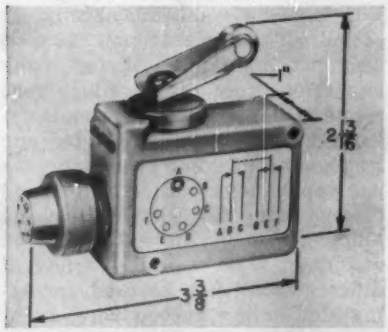


Pneumatic Impact Machine Has Variable Stroke

Heidrich-Nourse Model 200-VS pneumatic impact machine is smaller, lower-priced edition of company's Model 3-VS. Machine operates on the principle of a single-shot air hammer, but uses constant air pressure and variable hammer stroke. Traverse of tool to work is automatic, controlled by a foot valve. After contact an over-travel in the mechanism opens the hammer valve.

Impact cylinder assembly can be mounted at any angle, can be used as part of multiple-operation machines. Impact range is from 0 to equivalent of 8000 lb static or squeeze pressure. Max speed is 6000 cycles per hour.

Heidrich-Nourse Co, 631 E Third St, Los Angeles 13, Calif



Micro Switch Limit Switches Are Environment-Proof

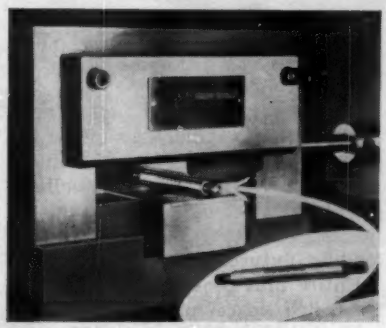
Series EP switches are designed for applications where environmental conditions are severe. In addition to being completely sealed, switches contain an inert gas which prevents their operations from being affected by atmospheric changes or abnormal environment.

Variety of electrical-rating and circuitry selections is available in either side- or bottom-mounting designs. All switches have their circuit diagram printed on side to simplify wiring.

Micro Switch, Div of Minneapolis-Honeywell Regulator Co, Freeport, Ill

Sur-Braze refractory, a castable ceramic for use in automation of brazing and soldering, is said to be particularly suitable for symmetric tubular assemblies. Low heat conductivity eliminates fixture jamming, permits closed assembly tolerances. Available in 4 x 8 x 1¼-in. jig blocks; suitable for operating temps up to 1800 F.

Technion Design & Manufacturing Co, 262 Mott St, New York 12, NY



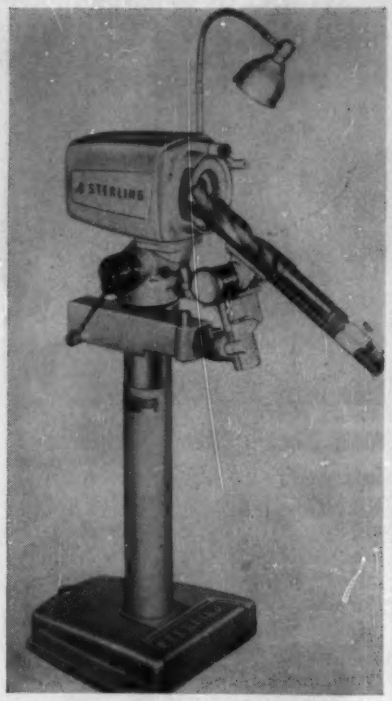
Shaper Attachment Marks Round or Tubular Pieces

Cunningham Shapo-Marker is designed for marking round or tubular pieces in conjunction with the ram of a shaper. Unit is composed of a main fixture which is locked into shaper vise and a shaft which is mounted in the toolpost of the ram. Shaft is connected to a hardened steel block which applies pressure and pushes the round piece being marked across the marking dies located in base of the fixture. When tubular pieces are being marked, an arbor is required to prevent distortion.

Marking dies may be either solid or insert type. Replaceable hardened and ground plates are used to set depth of marking. Needle bearings are included in fixture above steel block for smooth operation.

Fixture can be used for stamping flat parts by providing a roller instead of a flat block.

M E Cunningham Co, 1062 Chateau St, Pittsburgh 33, Pa



90° to 140° Included Angles Ground on Sterling Drill Grinder

Model DV Sterling drill grinder grinds drills to any included angle from 90° to 140° by an adjustment said to be simple and accurate.

Changing the included angle is accomplished by tilting the grinding wheel head instead of adjusting the workholding unit. Angle adjustment is made by a hand wheel controlling a rack and pinion. Positive lock in the wheel holds the head at any angle.

Built-in clearance gage indicates clearance angle being ground on any size drill. It is claimed that drills are ground so completely that it is unnecessary to grind heels off by hand.

McDonough Manufacturing Co, Eau Claire, Wis

Adapter System

Go & Go adapter system for use on milling machines consists of a heavy-duty end mill adapter and auxiliary arbor and holder.

Adapter mounts directly on front spindle flange, eliminating need for draw-in-bolt adjustments. Four bolt holes and key slots provide for rigid mounting and positive drive. Two set screws hold straight shank heavy-duty end mills and auxiliary equipment. Adapter is standardized for No. 50 NMTB face mill drive machines. Details in condensed catalog No. 2.

Goddard & Goddard Co, Box 68, Brightmoor Sta, Detroit 23, Mich

Mall Electric Metal Nibbler In Low-Priced Design

High-powered to cut No. 18 gage in mild steel (0.058 in.), electric metal nibbler cuts in a series of punches instead of using a shearing technique. Portable tool takes 2500 strokes per minute, with a 0.16-in. stroke length.

Nibbler is powered by a universal-type motor, with spur gears of 34-pitch hardened alloy steel. Housing is die-cast aluminum, and entire tool weighs only 5½ lb.

Tool is reported by maker to be ideal for scalloping and cutting curves in aluminum.

Mall Tool Co, 7725 S Chicago Ave, Chicago 19, Ill

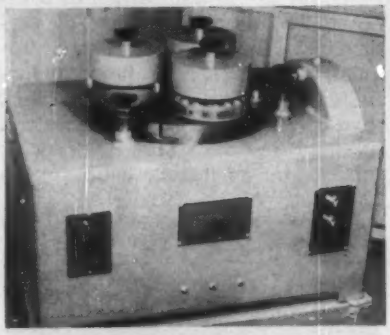
Improved Norelco X-ray Unit

Norelco MG 160-D provides either 40° or 120° apertures for rapid inspection. Newly designed tubehead has a 1.5-mm focal spot, rotatable indexing radiation diaphragm, and two apertures 180° apart. Locking device fixes either aperture in position for use, and red line indicates tube focus position.

With the 120° aperture and eccentric placement of the tubehead within a cylindrical vessel, two radiographs are sufficient to cover the entire circumference.

Tubehead also contains the 143-lb high tension generator of 160,000-v output. Accompanying 99-lb stepless control has built-in time totalizer and permits selection of voltages from 75-160 kv at currents up to 6 ma max. Combination tube and generator unit is 39 in. long; power supply is 230 v ac.

North American Philips Co, Research & Control Instruments Div, 750 S Fulton Ave, Mount Vernon, NY



Empire Lapping Machine For Carbide Inserts

Semi-automatic lapping machine is designed for grinding of carbide tool inserts and throwaways. Machine is furnished with one set of toolholders for square, round, and triangular inserts; one charge of abrasive; and loading fixture.

Entire unit requires only 18 x 24-in. bench space, operates on 110-v, ac current, and requires 200 watts power.

Loading and unloading are manual, grinding operation is automatic. Machine is less expensive than the average diamond abrasive wheel, according to manufacturer.

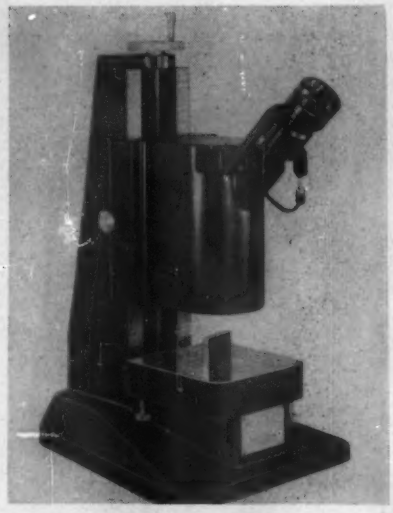
Empire Corp, 1566 S 83rd St, Milwaukee 14, Wis

Pneumatic Silencers for Air-Operated Equipment

Quietaire silencers are all-metal units that are reported to reduce sound in noise-shock areas close to the level found in the average factory (75 decibels). Units have no parts that need replacing. Made entirely of metal, they are corrosion-resistant and are said to be safe for any pressure normally encountered in industrial pneumatic service.

Silencers are produced in four models for pipe sizes from ⅜ to 1 in. Diameters range from 1¼ to 2 in., and lengths from 3¼ to 8½ in.

C W Morris Co, 10628 Cloverdale, Detroit 4, Mich



Optical Testing Equipment

Davidson plano-interferometers are claimed to give accuracy of inspection to one half-millionth of an inch in surface flatness (0.0000005). Work being tested never comes in contact with the optical flat. Test flat is housed in the machine and its surface flatness is measured against the tested work surface by visual process only.

Interferometers are made in vertical and horizontal types for inspection of different-shaped objects. The vertical will check flatness of any piece up to 3 in. thick and 8 in. long. Working aperture of the instrument is 5 in. The horizontal will check objects from paper thickness to 6 in., capable of being placed on the worktable. Models are available with 6½ x 6¾-in. table, or 8 x 8-in.

Davidson Manufacturing Co, West Covina, Calif

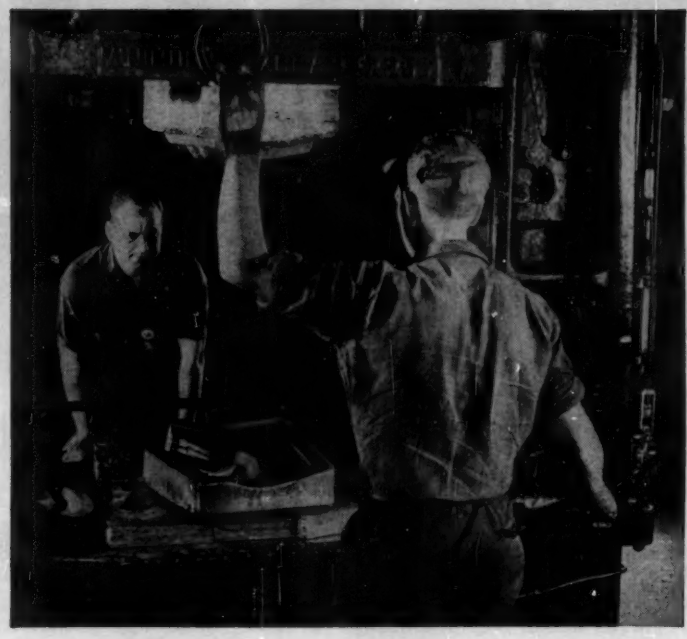
New Welding Additive Cuts Hardfacing Costs

WC Basic, a compounded mixture of alloying elements and flux, is said to eliminate need for many expensive specialized alloy rods required for hardfacing metals.

Product can be applied by any gas or arc-welding technique. In gas applications, rod is heated and dipped into the additive, causing alloying elements to adhere to rod and enter weld deposit. Variety of different rods may be used, including high or low carbon wire, stainless steel wire, mild steel, or cast iron, to achieve desired hardfacing qualities. One pound of the additive reportedly contains as much alloying element as 2½ lbs of high-alloy hardfacing rods.

Western Carbide Plant, 6840 Vineland Ave, N Hollywood, Calif

use 'dag' dry films for trouble-free lubrication



Treat your steel forging dies with 'dag' Colloidal Graphite and increase the number of acceptable forgings per die by as much as 100 percent. The *dry lubricating film* formed by colloidal graphite protects both dies and forgings. Freedom from scaling and sticking often eliminates some of the usual finishing operations on forgings, and greatly extends die life.

'dag' Colloidal Graphite is much more effective than ordinary high-temperature lubricants, including the best of powdered graphite. It is high-purity, electric-furnace graphite, specially treated by Acheson to produce microscopically fine particles. Dispersed in many fluid carriers for convenient application, 'dag' Colloidal Graphite will not burn, flake, or gum, at temperatures commonly encountered in metalworking operations.

'dag' dispersions are used profitably in stamping, deep-drawing, piercing, casting, forging, stretch-forming, and wire drawing. You'll find a surprising number of ways to use 'dag' dispersions described in our free booklet on 'dag' Colloidal Graphite for Metalworking Operations. Write for Bulletin No. 426-N3.

You can double the service life of steel forging dies

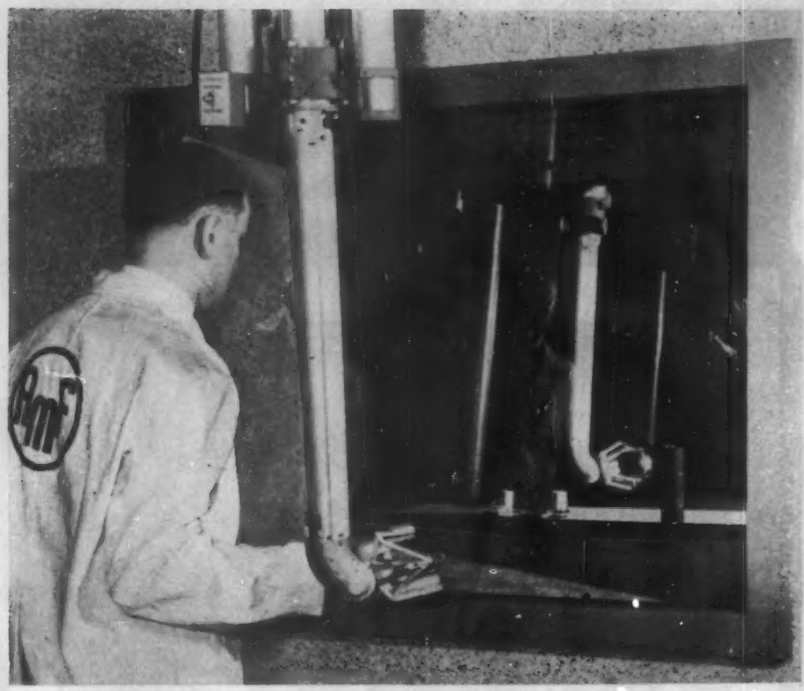
Dispersions of molybdenum disulfide are available in various carriers. We are also equipped to do custom dispersing of solids in a wide variety of carriers.

ACHESON COLLOIDS COMPANY

PORT HURON, MICHIGAN

...also ACHESON COLLOIDS LIMITED, LONDON, ENGLAND

Figure your saving with



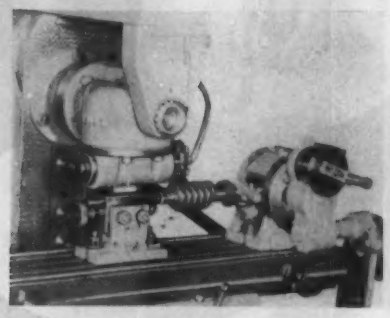
AMF Remote Handling Device For Radioactive Materials

AMF Atomic's Master Slave Manipulator, Model No. 8, is device for handling radioactive materials in nuclear research. Device has a "slave" wrist action that practically duplicates human wrist action, according to maker, allowing operator to perform complex hot-cell operations with relative ease and complete safety.

Unit is capable of handling weights up to 30 lb, and is made in a variety of tube lengths to fit shielding walls for both high-level and low-level hot cells. Device has "Z" motion of either 36 or 39 in. and a full slave-arm length of approximately 7 ft.

Available in both left- and right-hand models, each unit includes a general-purpose tong and through-wall tube shielding.

AMF Atomics Inc, Div of American Machine & Foundry Co, 261 Madison Ave, New York 16, NY



Greaves Milling Attachment Performs Variety of Jobs

Universal milling attachment was designed for work on Greaves horizontal milling machine. Unit is attached by three bolts to machine column face, supported by arbor support and overarm, and driven from machine through helical bevel gears. Operations performed include gear cutting; tool work on jigs, fixtures, and dies; and spiral milling, when used in conjunction with a dividing head and lead attachment.

Attachment is equipped with two graduated swivels, so that head may be rotated 360° in each of two planes to provide any cutter position. Spindle speed is at 1:1 ratio with machine spindle speed. Choice of No. 10 B & S or No. 40 spindle nose is permitted. Smaller cutters are mounted in Style C arbors.

Greaves Machine Tool Div, J A Fay & Egan Co, 2011 Eastern Ave, Cincinnati 2, Ohio

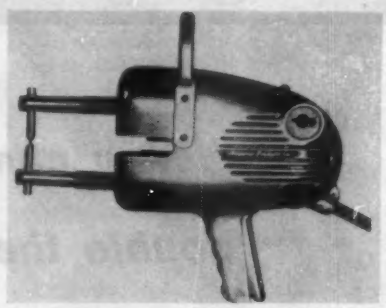
Pantograph Marker Is Multi-Purpose Machine

A. A. Gage's Panto-Marker, precision machine operating on the pantograph principle, is designed to mark soft and hardened materials using various methods: electric etch, vibro etch, acid etch, and engraving. Markings can be made in a range of sizes from 1/32 to 3/16 in. in height.

Font of letters and characters is furnished from which inscriptions can be arranged; by tracing them, the inscriptions are transferred by the pantograph arrangement to the stylus or diamond point and impressions are made on the object to be marked.

Work table travels up and down by means of a handle, will accommodate parts up to 32-in. height with unrestricted width. Table adjusts laterally or in a circular direction. Head will swing back and forth to adjust to the work.

A A Gage Co, 350 Fair St, Detroit 20, Mich



Portable Spot Welders

Ampower Model 55 spot welder (illustrated) will handle a combined thickness of 3/16-in. cold rolled steel. Electronic timing control operates a solenoid contactor which is mounted on the end of the power cable; operator touches dial, squeezes handles, and machine does the work.

Larger welder, Model 5403, also has built-in electronic timing control and solenoid contactor. Transformer arms and tips are water cooled.

Ampower Products Co, PO Box 464, Oak Lawn, Ill

Figure your saving with

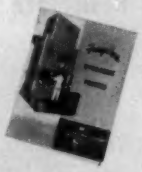
FARQUHAR PRODUCTION PRESSES

Figures don't lie when they show you why and how Farquhar Production Presses save money. It's as easy as this . . . when you want to form material, check with the Farquhar Press Engineer. He'll show you, in plain dollars and cents, how standard Farquhar Production Presses can do your *particular* job easily, quickly, and at lower cost.

Every Farquhar Production Press has these value-packed advantages . . .

- Rapid advance and return of the ram—for highest production.
- Extra-long guides on the moving platen—for greatest accuracy.
- Finger-tip controls—for easy, smooth operation.
- Positive application of speed and pressure on the die—for longer press and die life.
- Minimum maintenance . . . dependable service.

Get the facts on Farquhar Production Presses . . . send for catalog describing the basic sizes and types of Farquhar Presses. Write: A. B. Farquhar Division, The Oliver Corporation, Press Dept., York 11, Penna.



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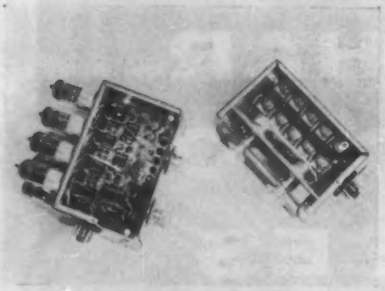
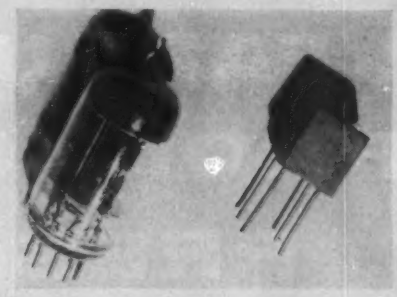


DECIMAL COUNTING UNIT using magnetic amplifiers (rt) alongside vacuum-tube unit



VACUUM TUBE ON LEFT is compared with magnetic amplifier designed to replace tube

Berkeley Magnetic Amplifier Used in Two Instruments

Ferristor is tiny magnetic amplifier designed to replace vacuum tubes in electronic equipment. Device, a wire-wound coil on a ferro-magnetic core, is cast in an epoxy resin cube only ½ in. on each side. According to manufacturer, device is immune to shock, moisture, prolonged overloading, or vibration; life expectancy is at least five years. Ferristor obtains its power from an RF oscillator, may be used everywhere a vacuum tube is used in comparable electronic instruments.

Ferristor is incorporated in two of company's electronic instruments. Series 5840 dual preset controller, termed Magnetic, is line of high-speed counting devices providing output information at any two counts within maximum capacity of the unit. Counter-controller is capable of 10,000 counts per second, requires only two vacuum tubes where older model required 54. Input pulses may be obtained from photocells, magnetic pickups, electrical contacts; output signal, through a built-in 5-amp relay, operates solenoids, power relays, or other control devices.

Second magnetic instrument available is EPUT (events-per-unit-time) meter, Model 7650, which consists of input amplifier, gate which is opened and closed by a tuning-fork-controlled time base, and a series of magnetic decade counting units. Instrument measures events occurring during a precise 0.1, 1, or 10-sec interval, displaying results in direct-reading digital form. Operating from a photocell, magnetic pickup, or any suitable transducer, it gages pressure, temperature, flow, velocity, viscosity, frequency, rpm or counts events or objects at rates to 40,000 counts per second.

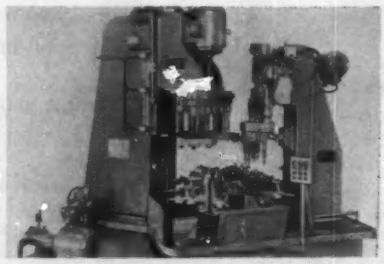
Berkeley Div, Beckman Instruments, Inc, 2200 Wright Ave, Richmond 3, Calif

Electronic Tap Welder Welds Resistance Wire

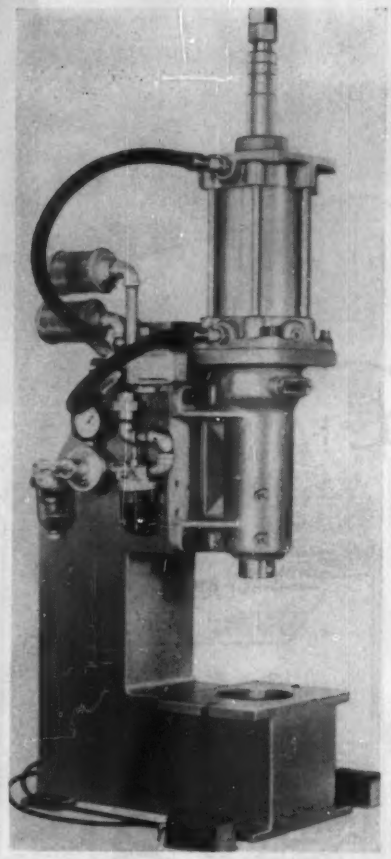
Model TW-1 is precision instrument for welding resistance wire of 0.007 to 0.025 in. Unit is designed for production line use where consistent direct wire-to-wire and wire-to-element welds are needed without applying pressure.

Tap welder contains sensitive ohmmeter for measuring tap resistances and other resistances independent of welding operations. Power input circuit is fuse protected, and sensitive voltmeter facilitates adjustment of welding current.

Electronics Div, William I Mann Co, 104 E Foothill Blvd, Monrovia, Calif



AUTOMOTIVE FORGED-STEEL STEERING KNUCKLES are produced at rate of 60 per hour on four-station horizontal indexing machine. Unit employs standard Hartford components to perform various operations — *Hartford Special Machinery Co, Hartford, Conn*



Famco Air Press Is Double-Acting

Designed to permit increased vertical heights, throat depth, and ram stroke, Famco air press has double-acting air cylinders which support unlimited upper die weights and permit fast operating cycles. Double-rod ends allow for adjustment of stroke from 0 to maximum stroke of cylinder.

Ram is supported and guided independently of cylinder piston rod and is keyed to prevent turning. Ram housing is adjustable in 2-in. increments up to 6-in. total to allow for variation of shut height on individual machine. Platen area has hole for operations requiring punch slug or workpiece clearance.

Lubricator, filter, regulator, regulating gage and two mufflers are furnished as regular equipment.

Famco Machine Co, 3100 Sheridan Rd, Kenosha, Wis

Micro-Projector, called Minipro, includes a complete miniature precision microscope with revolving triple nosepiece and objectives providing magnifications from 200 to 800. Projected images are clearly defined at distances of 10 ft.

William J Hacker & Co, 82 Beaver St, New York 5, NY

NEW

No. 3-36
HYDRAULIC MILLING MACHINE

Now—the family of Kent-Owens Milling Machines has expanded to give you the same unexcelled milling accuracy, speed and dependability for *larger size work!*

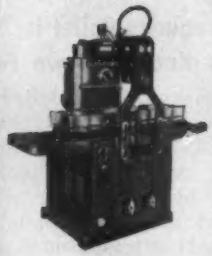
Proudly we present the No. 3-36 Hydraulic Milling Machine . . . the new "big brother" in the line of popular Kent-Owens Millers. Each Kent-Owens machine is ruggedly designed with advanced features throughout for greater dependability and accuracy to maintain tough production schedules. Write for bulletin 955 on wide range of hydraulic and hand-operated machines. Also, let Kent-Owens design and build your tooling and special machines.

Kent-Owens Machine Co., Toledo, O.

Simple . . . Rugged . . . Efficient

No. 2-20DS . . . Double Spindle for two milling operations . . . 20" table travel . . . 42" x 12" table. Hydraulic feed.

No. 1-14 . . . 14" table travel . . . 32" x 9" table . . . hydraulic table feed . . . full automatic cycle.



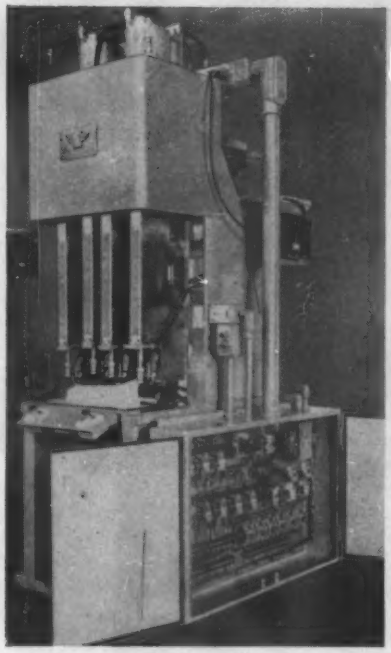
No. 2-20 . . . 20" table travel . . . 42" x 12" table . . . full automatic hydraulic feed.

No. 1-M . . . Hand feed to table and head . . . 25" x 9" table . . . 12" table travel . . . head counter-balance is adjustable.

Call on

KENT-OWENS
for MILLING MACHINES

KENT-OWENS REPRESENTATIVES

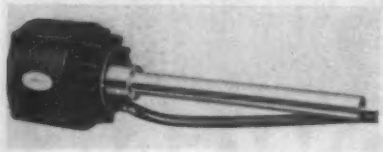


Stud-Driving Machine For Production Work

Two Syracuse models drive studs simultaneously at various angles up to 30° from vertical and at various heights up to 12 in. above the table. One model drives 1 to 6 studs, one drives up to 12 studs simultaneously. Production rate, from and to conveyor, is 4 to 6 seconds.

Vibrator hopper feed sorts and delivers the studs to the positioning fingers. To reduce distortion on die-cast work, hydraulic clamps hold components in an epoxy resin mold. Machine head is driven by a separate motor with its own interlocking control circuit.

Syracuse Special Machine Co, 2900 Erie Blvd E, Syracuse 3, NY



Automatic Collet Closer Added to Bellows Line

Model BCC-60 provides hollow spindle lathes and other rotating hollow spindle machines with automatic or semi-automatic stock holding.

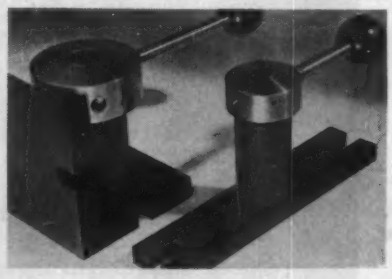
Device consists basically of a hollow drawbar mounted through the center of an air cylinder. Machine collet, fastened to the end of the drawbar, is opened and closed by operating the air cylinder. This is a non-rotating type, exerting a closing pressure equal to 25 times air pressure applied. Drawbar permits through-feeding of stock up to a max of 1 in. in diameter. Unit mounts directly to the machine head stock. It may be pushbutton-controlled by the operator or interlocked with the machine cycle for fully automatic operation.

The Bellows Co, Akron 9, Ohio

Arc-Welded Service Truck

Truck is designed to handle small pieces and bulk parts. Fabricated from 16-ga steel sheets and 1½ x 1½ x 1/8-in. angle iron. Truck is 32 in. tall, with two 3-in.-deep trays 16 x 30 in. Rubber casters are 4 in. dia. Handle is welded to frame.

Pollard Bros Manufacturing Co, 5505 Northwest Highway, Chicago 30, Ill

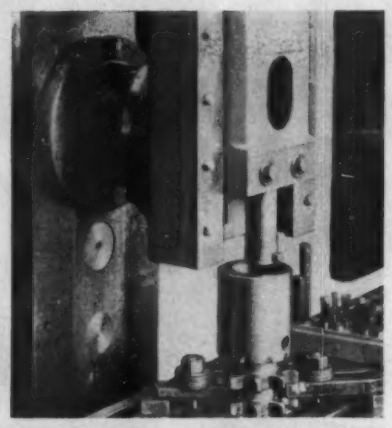


Arrow Quik-Lok Collet Vise Available in Two Sizes

Arrow Quik-Lok is a collet vise for use with standard collets, to hold finished parts, on drillpresses, milling machines, surface grinders, and other machines. Vise will accommodate work from ½-in. to 1-in. diameter, depending on model being used. Turning locking handle one direction locks work in place, while turning handle the other way releases parts.

Various models of this vise will use 1A, 3AT, 3C, and 5C collets. Special collets will be supplied on order. Prices of standard vises without collets range from $29.50 to $62.50.

Arrow Machinists, 17 N West St, Mount Vernon, NY



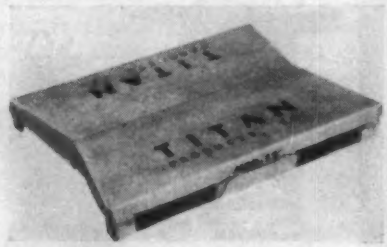
Greaves Slotting Attachment Has 4-in. Stroke

Slotting attachment designed for Greaves horizontal milling machine performs keywaying, slotting, and die or fixture work requiring slotting operations. Attachment mounts on column face of miller and is driven from machine spindle.

Head may be rotated and set at any angle through 180°. Adjustable eccentric drive provides any cutting stroke up to 4 in.

Additional features include graduated swivel for setting machining angle, 1:1 speed ratio with machine spindle, and provision for use of standard slotting tools with ⅝-in. or 1-in. diameter shanks.

Greaves Machine Tool Div, J A Fay & Egan Co, 2011 Eastern Ave, Cincinnati 2, Ohio



Titan 1-ton-capacity Pallet Is Delivered in Knocked-Down Form

Expendable paper pallet is delivered in knocked-down form, which is said to take only 25% of the storage space required by conventional pallets. Assembly is by stapling or wire-stitching, and assembled pallet is designed to hold at least 2000 lb, and can be stacked four-high without endangering base pallet.

Weight is 4 lb, and pallets are available in 32 x 40-in. and 40 x 48-in. sizes, with 2-way entry for fork trucks. Fire- and moisture-proof.

Titan Products Co, 165 E 74th St, New York 21, NY

SIDNEY

THE SIDNEY MACHINE TOOL CO. SIDNEY OHIO U.S.A.

outstanding in 3 great requirements

which are indispensable in furnishing amazing speeds on work of utmost precision . . . *LOWEST COST PER PIECE.*

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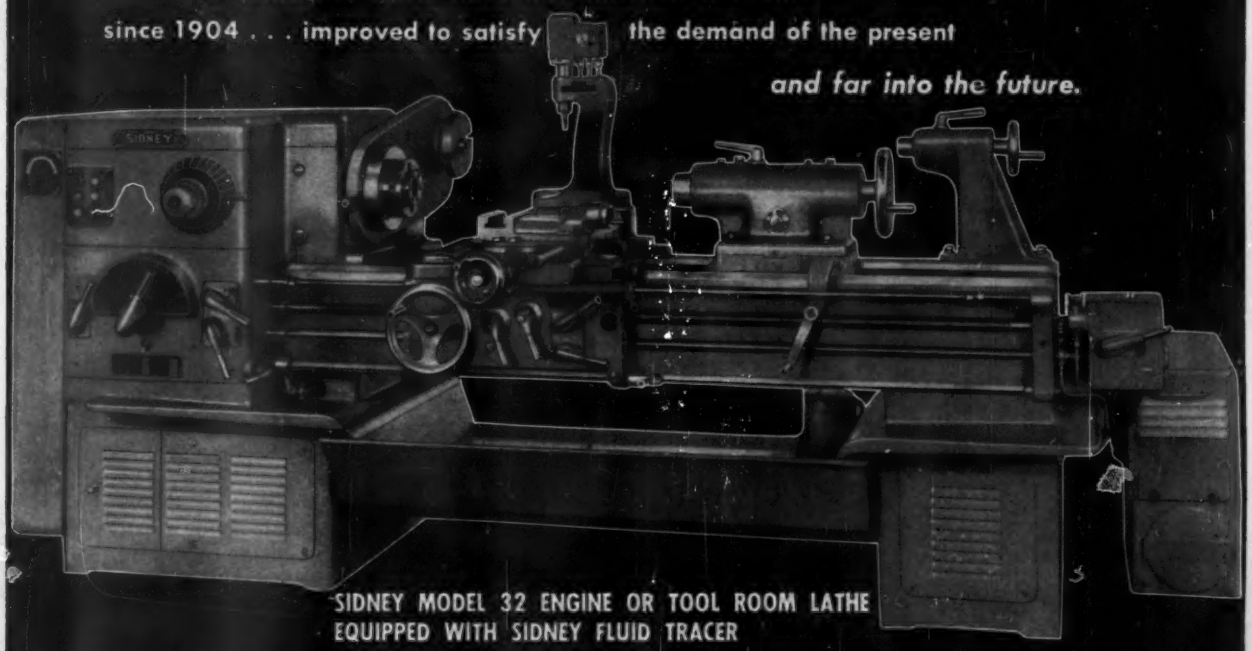
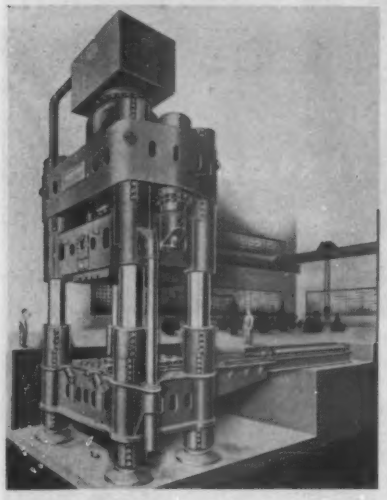
NEW . . . PRACTICAL . . . DEPENDABLE . . . DESIGNED to do MORE for you at LESS COST. Built on the fundamental SIDNEY principles which have won international fame since 1904 . . . improved to satisfy the demand of the present *and far into the future.*



SIDNEY MODEL 32 ENGINE OR TOOL ROOM LATHE EQUIPPED WITH SIDNEY FLUID TRACER

THE SIDNEY MACHINE TOOL CO. • SIDNEY, OHIO

Builders of Precision Machinery since 1904



Hydraulic Forging Press In 8000-Ton Model

Lake Erie hydraulic forging press of downstroke, column-type design is accumulator-operated with 4500 psi water pressure. 8000-ton machine is used for forging heavy aluminum billets.

Working area between positive stops is 98 in. left to right and 58 in. front to back. Diameter of main column is 28 in. Stroke of main and side rams is 72 in.; ejector stroke is 12 in. Maximum daylight is 110 in., minimum is 38 in. Sliding bolster arrangement provides 112-in. stroke for die removal.

Main ram presses at 5335 tons and side rams operate at 1485 tons. Rams are chrome plated for protection against rust, and cylinders are of inserted forged steel.

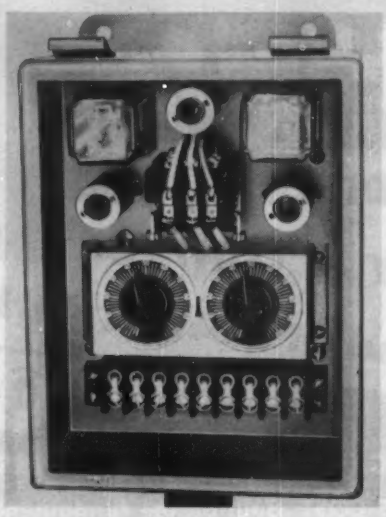
Lake Erie Engineering Co, Box 68, Kenmore Station, Buffalo 17, NY

Complete Plating Plant In Compact, Portable Unit

Sel-Rex Jet Plater, fully automatic, consists of a Sel-Rex selenium rectifier with automatic timer, stainless steel tank (which may serve as the anode) fitted with a water jacket for temperature control; movable work rack to accommodate portable plating barrel; centralized control panel equipped with Weston ammeter and Powerstat control; filter; and drip-proof pump with motor. Jet agitation is accomplished through a pump and perforated stainless steel tube at bottom of plating tank.

Standard models require approximately 18 x 38 in. of floor space and are available in 10, 20, and 30-gal capacities.

Bart-Messing Corp, 229 Main St, Belleville 9, NJ



On-Off Electronic Timer Has High Load Capacity

Ferrara Model T3 has independently adjustable on and off time ranges, load contacts rated at 20 amp 115 v ac, non-inductive load.

Circuit employs cold cathode tubes requiring no warm-up time before use. Accuracy is ±1% and independent of line voltage fluctuations from 105-125 v. Standard available ranges are 0.3-25 sec per section and 0.5-50 sec per section, with other combinations available. Timer is available in open style (T3A) or NEMA XII (T3C) construction.

Ferrara, Inc, 8106 W Nine Mile Rd, Oak Park 37, Mich.

Diamond saver for use on J&S Fluidmotion wheel dresser (standard on all new production models, available independently for attachment on models in use) consists of a tapered V that permits rotation of diamond at negative angle. As a flat develops on wear side, diamond is revolved to a sharper side, retaining original concentricity to shank.

J&S Tool Co, 87 Dorsa Ave, Livingston, NJ

Compact Lubricator Simplifies Small Machine Maintenance

Type NV automatic unit with close-fitting ratchet drive is designed to provide centralized lubrication on small machines where minimum installation space is available. Cyclic-type lubricator will feed controlled amounts of oil to as many as 25 bearing points.

Piston-design pump discharges oil at 30 psi into a distribution system of 5/32-in. tubing. Reservoir in bottom of unit has an 80-cc capacity; pump delivers 0.4 cc (12 drops) of oil per discharge. Lubricator is available with any of four different sets of steel hobbed reduction gears providing ratios from 100/1 to 2¼ million/1. Ratchet arm oscillates up to 200 strokes per minute at working angle of from mm 15 to 85°, depending on application.

Bijur Lubricating Corp, 151 W Passaic St, Rochelle Park, NJ

Tungsten Carbide Plug Gages

Regal reversible plain plug gages are of tungsten carbide, are reported to have accurate life up to 50 times greater than similar steel gages. As ends become worn, they can be reversed or cut off because of the extra-long gaging members. Tungsten carbide resists corrosive actions, is non-magnetic.

Gages are furnished in sizes from 0.025 to 1.010 in. To minimize weight, plugs 0.500 in. and larger are furnished with a hole through the member ½ diameter of the member.

Regal Div, Beloit Tool Corp, Beloit, Wis

ROCKWELL-BUILT

now, a great new long-bed DELTA 11" metal cutting lathe

. . . new, big capacity 5-foot bed—plus all the exclusive Delta quality features that have gained industry-wide acceptance for the standard model.

. . . designed for production work as well as tool rooms and experimental shops—lets you handle many production jobs that normally would require far more expensive machines.

. . . combines real precision for close control, with extra ruggedness for heavy duty service—all at a price so low it's almost unbelievable!

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Delta Power Tool Division, Rockwell Manufacturing Co.
618M North Lexington Avenue, Pittsburgh 8, Pa.

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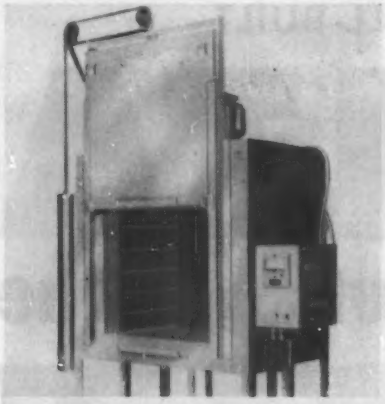


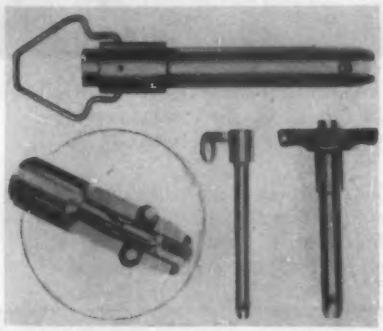
Blue M Forced Air Recirculating Oven

Temp-O-Loy, automatic recirculating oven designed for preheating and stress relieving of magnesium, aluminum and newer alloys, is constructed of heavy-gage steel with dual firebrick and Thermoblock insulation. Oven is mounted on wheels for mobility, has diagonal air flow, and provides temperatures up to 1000°F.

Air is mechanically circulated by double-alloy turbo blowers from both side walls, which contain Modella heater banks. Alloy radiant shields provide fast heat transfer and uniform temperatures. Units are equipped with automatic electronic indicator and controller and time-temperature programmer.

Oven is available in two sizes of 18 and 36 cu ft working space, is designed for 230 or 440 v single or 3-phase operation.

Blue M Electric Co, 138th & Chatham St, Blue Island, Ill

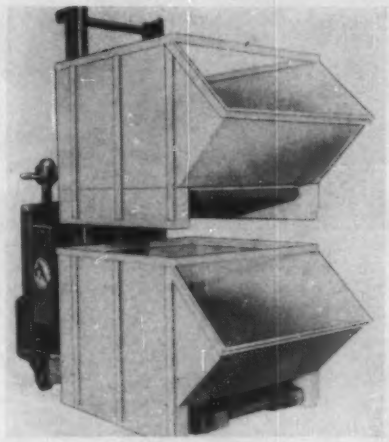


Quick-Action Ball-Lok Pins Speed Production Assembly

Price Ball-Lok pins are single-action type, either push or pull, for simplicity of operation. Push-type pin cannot be accidentally released; release button must be depressed to disengage the lock at the time pin is pulled.

When pin is inserted, or in a locked position, chrome steel balls protrude beyond the body assembly where they are firmly locked by the large diameter of the spring loaded plunger. Pushing the release button allows the balls to sink below the diameter of the body assembly, leaving pin free to be inserted or removed. Models which are mallet driven are also available, as well as remote control type. Available in a range of eight styles in 16 sizes.

Distributed by Rowe Sales Co, 2140 Westwood Blvd, Los Angeles 24, Calif



Large Palletized Stackbins

Units for bulk parts handling and storage are said to be particularly useful as intra or inter-departmental carriers for heavy small parts or irregularly shaped materials.

Construction is all-welded heavily reinforced sheet steel; underclearance fits all types of fork and platform trucks. Hopper front keeps contents visible and easily accessible. Individual bins may be safely stacked as high as desired. Unit illustrated has capacity of four large drums, is 36 in. wide by 24 in. deep by 48 in. long, including 12-in. hopper front.

Stackbin Corp, 1091 Main St, Pawtucket, RI

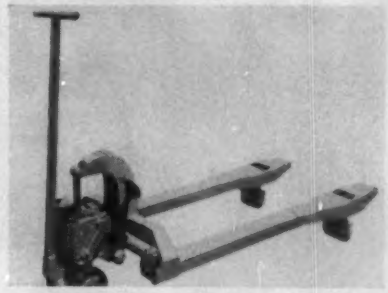
Do-It-Yourself Crane Assemblies Made From Series of Kits

Conco assemblies include underhung hand-geared crane assembly, top-running hand geared crane assembly, and both single- and multiple-trolley underhung push-type crane assemblies, each available on package basis.

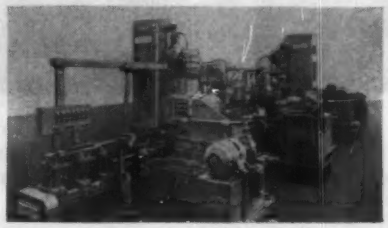
Assemblies are shipped with all necessary parts except I-beam and cross-shaft. Company reports that any of the cranes can be assembled by one man in a few hours.

Underhung and top-running cranes have rated capacities ranging from ½ to 5 tons, while single-trolley, push-type crane can be built to capacities from ½ to 1 ton. Multiple-trolley cranes have ½ to 2-ton capacities, and span to 30 ft.

Material Handling Div, Conco Engineering Works, Mendota, Ill



HAND LIFT TRUCK designated Model A handles pallets with loads to 2000 lb. Model lifts pallet four in. from ground with nine foot-pedal strokes, can be built to handle standard pallets of 30 to 72 in. in 6-in. increments. Standard overall fork widths are 24, 27, and 30 in. Truck utilizes compression tubes for lifting —*Yale & Towne Mfg Co, 11000 Roosevelt Blvd, Philadelphia 15, Pa*



AUTOMOTIVE ENGINE EXHAUST MANIFOLDS are produced at rate of 106 per hr at 75% efficiency on segmented transfer machine designed and built by Snyder. 20-station, 43-ft-long machine features twisted slide rail arrangement that moves and orients manifolds without the use of pallets. When manifolds are halfway through machine, rails twist to tilt parts 45° for machining, thus avoiding auxiliary orienting devices. Machine performs all machining operations on manifolds except the mounting faces, which are ground prior to loading — *Snyder Tool and Engineering Co, 3400 E Lafayette Ave, Detroit 7, Mich*

Look into REVERE Phosphor Bronze – it pays RAVENNA to use it!

This Moen Single Handle Mixing Faucet contains an anchor disc and an anchor washer, both stamped out of Revere Phosphor Bronze Strip. These are small parts, but in a fine product such as this faucet, high quality metals must be used throughout. Here is a condensation of the manufacturer's experience with the phosphor bronze:

Anchor Disc: • Standard punching speed maintained. • No pre-straightening off the arbor for the automatic punching process. • No excessive die wear. • Corners are sharp and clean; no de-burring needed. • Natural mill finish is better than they could achieve by tumbling or burnishing. • High tin content means no lubrication is required; they call it "silent brass."

Anchor Washer: • Have not had a single surface failure. • Dry tumble to de-burr. • Good fatigue characteristics and no obvious signs of corrosion.

Revere offers several types of phosphor bronze, each with slightly different characteristics. In addition to this alloy, Revere also supplies Ravenna with round and octagonal leaded brass tube and free-cutting brass rod, for use in various parts of the valve. We will be glad to collaborate with you on selection of just the right forms of the correct alloys for your products, present or projected. See the nearest Revere Sales Office.

Moen Single Handle Mixing Faucet, made by Moen Valve Co., Division of Ravenna Metal Products Corp., 6518 Ravenna Ave., Seattle 15, Wash.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

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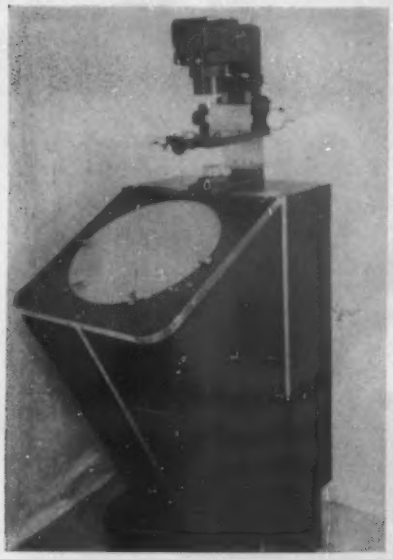
Mills: Baltimore, Md.; Brooklyn, N. Y.; Chicago, Clinton and Joliet, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif., New Bedford, Mass., Newport, Ark.; Rome, N. Y. Sales Offices in Principal Cities, Distributors Everywhere.

"The Revere Four-Way Service" is a 16 mm. sound motion picture in color, educational and informative. If you haven't seen it, write nearest Revere Office.



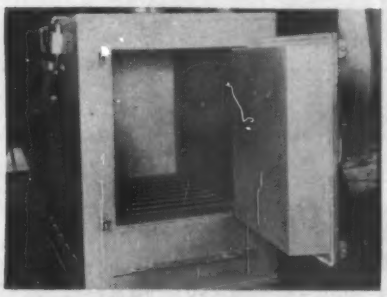
Portman Optical Comparator Has Duplex Design

Model P-6 optical comparator has duplex-type design which permits instrument to be used as upright floor model for vertical projections or as horizontal model on shop bench. Standard 14-in. screen is incorporated in unit.

Accessories available include pedestal-type base and a right-angle universal coordinate measuring stage equipped with dial indicators. Measuring stage can be used in either horizontal or vertical plane.

Lenses provide magnifications of 10, 20, 25, 31¼, 50, and 100X. Unit is 47 in. long, 26 in. high, and 18 in. wide. With pedestal base, instrument stands 56 in. high.

Portman Instrument Co, Town Dock Rd, New Rochelle, NY



Gas-Fired Oven Has Wide Temperature Range

Grieve-Hendry gas-fired oven was designed for operations that require an oven with adjustable temperature control from 100°F to 1000°F. Unit is reported especially useful for operations such as burning off old insulation on electric motors and baking on new varnish after rewiring.

All-steel construction includes a cabinet within a cabinet with 5 in. of rock wool insulation. Heavy-duty grate is built in over the gas burners at bottom of oven. Removable drip pan may be taken out for cleaning while the oven is in operation.

Work space on standard oven is 26 in. x 30 in. x 30 in. deep. Other sizes and specifications are available. Oven can be built for heating electrically.

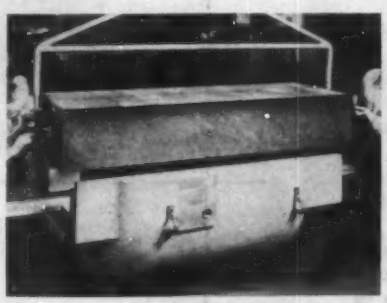
Grieve-Hendry Co, 1401 W Carroll Ave, Chicago 7, Ill

Power Filing Tool

Reciprofiler is profiling machine designed to replace hand file. Driven by flexible-shaft machine with rheostat, tool will rotate and reciprocate simultaneously. Adjustable reciprocating stroke of from 0 to ⅜ in. can be operated at any desired speed up to 15,000 strokes per minute.

Portable tool may be used for filing, honing, lapping, polishing, chafing, sawing, milling, grinding or engraving. Complete line of accessories for various operations is available.

Nord Corp, 108 Spruce St, Nutley, NJ



Square Edge Surface Plates

Development of black granite surface plates with one or more edges precision finished square with the top surface has been announced by Rahn Granite Surface Plate Co.

The 28 x 84 x 14-in. plate illustrated is being used to spot the rails of a universal vertical grinder. The 28 x 84-in. surface, which spots the rear of top and bottom rails, is claimed to be lapped uniformly convex to a max tolerance of 0.0003 in. at the center, with 0.0001-in. on the diagonals. The 14 x 84-in. edge is lapped uniformly concave, with max tolerance of 0.0003 in. at center of the 84-in. length, and square with the top surface to 0.0003 in. in 14 in. Convex face spots back of rails; concave square edge spots rail bottom to compensate for weight of the grinder head.

Rahn Granite Surface Plate Co, 644 N Western Ave, Dayton 7, Ohio

Dewpoint controller, a self-contained unit, automatically controls dewpoint of an atmosphere generator or heat treat furnace; applicable to processes where permanent record is not required. Operates with electronic control system using a resistance bulb as sensing element.

Surface Combustion Corp, Toledo 1, Ohio

Water wash paint spray booth, for all types of materials, has wash chamber section elevated above dry section of booth. Heavy downflow of water falling on back wash curtain creates a filtering point; much of the paint residue is knocked down and contained within water reservoir tank for protection against fire and explosion hazards.

M&E Manufacturing Co, Dept S-287, 2571 Winthrop Ave, Indianapolis, Ind

Trig chart, for wall use, contains equations for right-angle and oblique-angle triangles, as well as for compound and spherical trigonometry. Price, $1.

James D Volts Associates, 3630 Eastham Dr, Culver City, Calif

Boring Bar Reduces Deflection

Boring bar, developed by Cyma Corp, is reported to reduce bending or bar deflection, while making deeper cuts with heavier feeds, by as much as 50% compared to bars currently available.

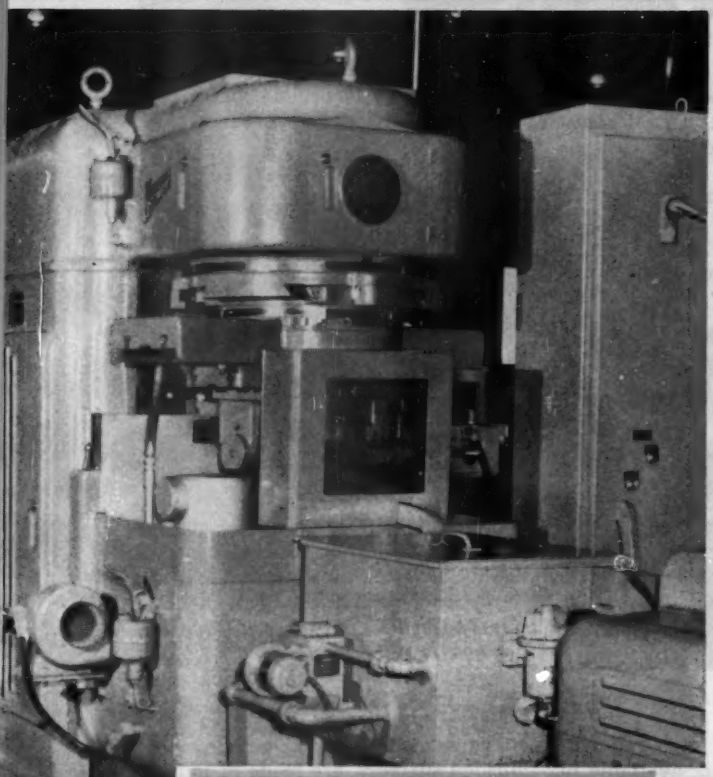
Three tungsten carbide strips are brazed into slots running lengthwise in the steel bar circumference extending to the portion of the bar subjected to greatest bending stresses. When strips are brazed in place, difference in thermal coefficient of expansion causes carbide to be preloaded in compression. Field tests indicate a resistance to deflection equal to twice that of a plain steel boring bar. Currently available in standard sizes from ⅜ to 1½-in.-dia.

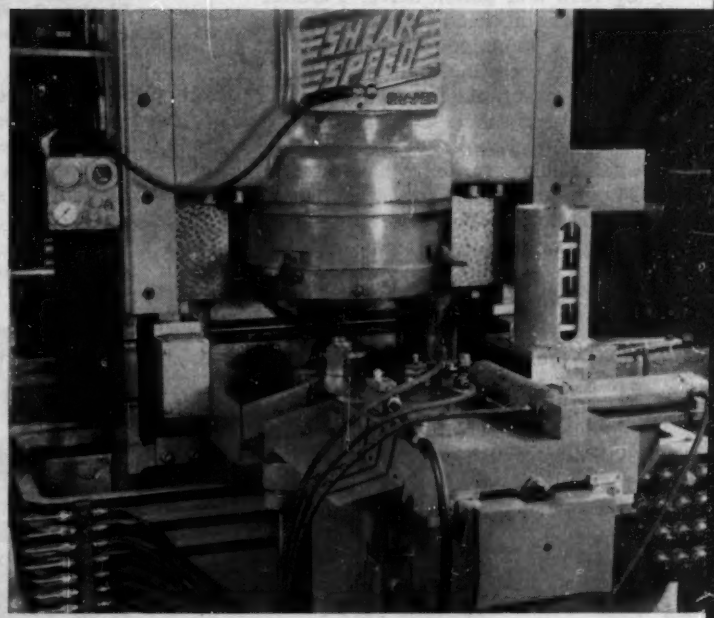
Cyma Corp, 3581 Kipling Ave, Berkley, Mich

This Month's

GEAR PIX

NEW LARGER ROTO-FLO spline roller, Model 1551, is capable of cold rolling toothed parts with diameters up to 2 inches. Complete information on this fastest method of forming splines and similar toothed parts is given in Bulletin RF-55.





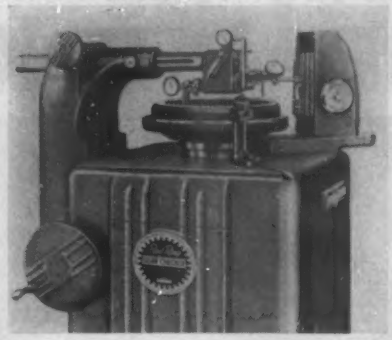
NEW AUTOMATIC LOADING for Shear-Speed gear shapers, plus automatic size control, offers completely automatic operation on all 1800 series models. Can be specified on new machines or added to Shear-Speeds now in the field.

CONTINUOUS, AUTOMATIC, FAST gear shaving on this Michigan 870-A gear finisher includes automatic size control, hopper feed, washing, and checking for correct size and helix angle. These Michigan gear shavers are used in continuous gear production lines—or in unitized groupings.

MICHIGAN TOOL COMPANY

7171 E. McNICHOLS RD. • DETROIT 12, MICH.

IN CANADA: COLONIAL TOOL CO., LTD.



Red Ring Gear Checker Inspects Internal Gears

Model SIG 18-in. gear checker inspects spur or helical internal gears up to 18-in. pitch diameter. Model checks internal tooth-to-tooth spacing, pitch or root diameter eccentricity and size, as well as parallelism of spur gears from 2 to 48 diametral pitch.

Machine consists of cast-iron base that supports a precision ball-bearing work spindle. Head that checks tooth spacing, size, and eccentricity is mounted on an adjustable overarm supported by a vertical cast-iron member which is slide-mounted on the base and raised up and down by rack and pinion drive. Parallelism checking head for internal spur gears is mounted on vertical ball slides in a casting that slides in and out on a sub-plate bolted to top of the base checker.

Model occupies 30 x 40-in. floor space; height to top of base is 40 in. Maximum diameter of gears that can be checked is 26 in.

National Broach and Machine Co, 5600 St Jean Ave, Detroit 13, Mich

Mercury Tractor Uses LP Gas System

Model A-460 "Banty" has LP gas installation which is said to prolong engine life and sharply reduce fumes and smoke.

Standard units required for conversion to LP system are filter, carburetor, solenoid valves, regulator, carburetor adaptor, and supply tank. Tractor uses an engine especially designed for LP gas operation.

Mercury Mfg Co, 4044 S Halsted St, Chicago 9, Ill

3-Way Solenoid Air Valve

S-3 series 3-way solenoid pilot-operated air valve has a positive bubble-tight shut-off, and is noncorrosive throughout. Compact design makes it adaptable for application on air clutches, air brakes, power feeds, and other pneumatic equipment. Operates without springs and is said to provide fail-safe performance. By rotating the pilot head, valve can be used normally open or normally closed.

Solenoid has a low amperage coil that operates on most ac and dc voltages (with 10-w max power consumption) and directs only two internal moving parts — spool and solenoid plunger. Each valve has a full pipe capacity with operating pressure ranging from 30 to 150 psi. Can be mounted in any position, base-mounted if desired.

Airmatic Valve, Inc, 7317 Associate Ave, Cleveland 9, Ohio

Smaller Circuit Breakers

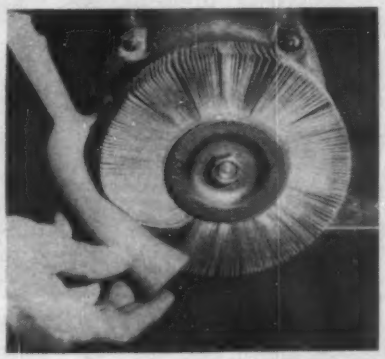
Use of Gibsiloy silver-tungsten electrical contacts in the new I-T-E E-frame circuit breaker makes it possible to obtain high ratings for small breakers.

Frame design makes possible ratings up to 100 amp at 250 v ac in a more compact breaker than previously required. Resulting space-saving means smaller over-all size of panelboards.

Gibson Electric Co, 8308 Frankstown Ave, Pittsburgh 21, Penna

Iron powder electrode, Improved Fleetweld 47, can be used in any position for high-speed welding of mild steel. Operates on ac or dc current; available in sizes from ⅛ to 5/16-in.-dia.

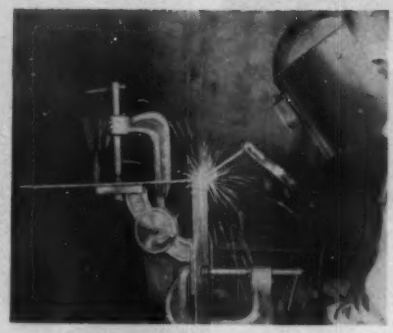
Lincoln Electric Co, 22777 St Clair Ave, Cleveland 17, Ohio



Gritted Cloth Wheel

Grind-O-Flex wheels have grit embedded in the cloth, are available in 10 and 12-in. diameters for mounting on buffing lathes and for heavier polishing and deburring operations.

Merit Products, Inc, 4023 Irving Place, Culver City, Calif



Adjustable Work Holder Made of Aluminum Alloy

Jergens Duo-Square adjustable work-holder holds two parts at any angle, for welding, brazing, soldering, or gluing. Tool's two clamping faces are adjustable from 0° through 180°, with change made by loosening single machine handle and moving indicator to desired angle on dial.

Device is made of aluminum alloy, which is designed to dissipate heat and eliminate adherence of weld spatter.

Jergens Tool Specialty Co, 712 E 163rd St, Cleveland, Ohio

Files available in complete Red Tang line include American Pattern files and rasps, "American-Swiss" Swiss Pattern files, Vixen milled curved-tooth files and holders, and rotary files and burs (HSS and carbide).

Simonds Saw & Steel Co, Fitchburg, Mass

Hydraulic vise No. 1004, controlled by two foot pedals, has closing speed of 1¼ in. per pump stroke; max hydraulic pressure, 7000 psi; max jaw pressure, 4000 lb; jaw width, 4 in.; depth, 3⅞ in.; jaw opening 6 in. Hydraulic power pump has replaceable cartridge containing valves for simpler maintenance.

Columbian Vise & M'f'g Co, Cleveland 4, Ohio

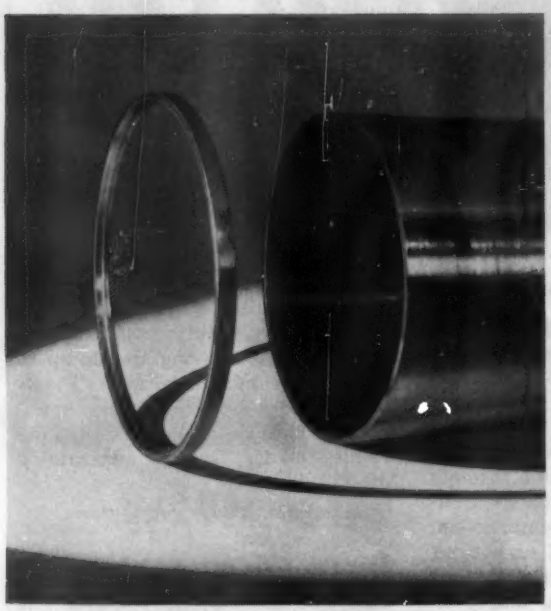
Coding ink withstands temps up to 1900 F, marks any size or shape of ferrous metal. Applied by roller coat, stamp pad, or marking pen device.

Ink Specialties Co, 519 N Halsted St, Chicago 22, Ill

Corner-Pads for sheet metal, to prevent scratching and gouging of finished surfaces, are made of tough, treated paper stock, pressure-sensitive. Available in two sizes, supplied in rack size rolls.

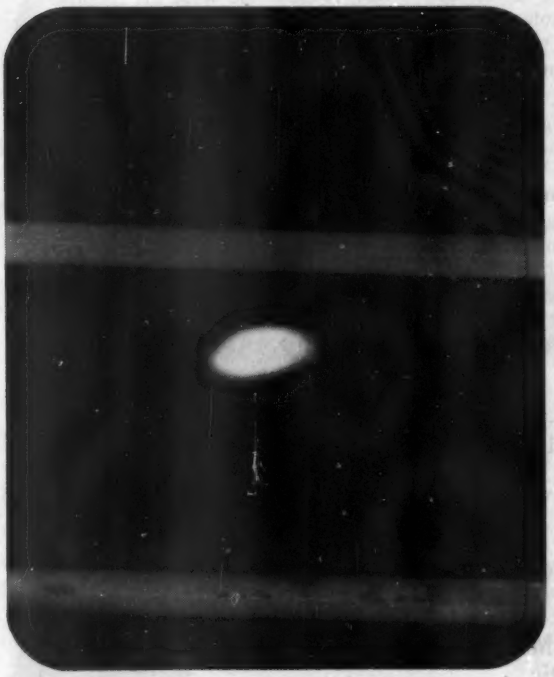
By-Buk Co, 4314 W Pico Blvd, Los Angeles 19, Calif

RADIOGRAPHY reveals...



This stainless steel ring must be brazed to the cylinder. The bond between them must be sound—for the ring must hold the cylinder in place despite high stresses.

a better way to yield a better job!



THIS IS where radiography has done a double job. First, x-rays probed the structure of the bond, showed when it met requirements or when lack of fusion meant the part must be rejected.

Then, radiography went further. It helped reveal a new technic for brazing these two parts—a technic which yielded sound joints almost every time.

So, add another instance where radiography is more than paying its way. By doing such jobs as this, by testing pipeline joints, by proving soundness of the welds in pressure vessels, it is opening up new fields to welders.

Radiography can help you build business as well as earn a reputation for good work. Would you like to discuss how? Talk it over with your x-ray dealer.

EASTMAN KODAK COMPANY
X-ray Division
Rochester 4, N.Y.

Radiography...

another important example of Photography at Work.

Kodak

tough sprayed metal

well-known maintenance method now profitable production process

equipment fabricators find tough, high-quality sprayed metals build big bonus pay-offs

Modern metallizing—metal spraying—which for many years has saved millions of maintenance dollars by restoring worn machine parts for thousands of companies, is now helping many others improve their products, cut production costs.

In the production of new equipment, tough sprayed metal coatings provide highly desirable mechanical or electrical characteristics at low cost, in high speed, semi-automatic production.

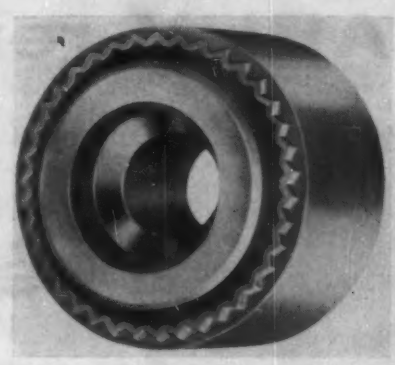
General Electric, for example, a long-time user of metallizing to provide superior wearing qualities on critical areas of large turbine shafting, now applies sprayed metals to a wide range of its products. Many forward-looking companies have instituted investigative programs in their research and design labs to explore the use of metallizing as a means of giving their products competitive advantages in quality, or performance or price—or all three.

Metallizing may be able to help your company improve its products, economically, reduce machine maintenance costs, cut your bills for corrosion protection. It may pay you well to look into it. In any event you will find it a fascinating subject. Bulletin 51 illustrates and describes "Metallizing—its practical applications"—shows actual work being done in users' shops. We shall be happy to send you a copy.

METCO

Metallizing Engineering Co., Inc.

1169 Prospect Ave., Westbury, L. I., New York
Telephone: EDGEWOOD 4-1300 • Cable: METCO
In Great Britain: METALLIZING EQUIPMENT COMPANY, LTD.—Chobham near Woking, England



Self-Clinching Drill Bushings Speed Templet Assembly

PEM line is designed for quick installation in drill templets made from thin gage aluminum or cold rolled steel.

Single hole is required for each bushing—the on-center hole through which the drill will pass. Self-clinching units are compression-mounted, one or several at a time, by any pneumatic or oil-hydraulic squeezer or arbor press, and positively locked into position. Alignment is automatic. High torque and pull-out resistance is provided by back-tapered shank and corrugated clinching ring. Bushing holes are burnished and held to tolerances of drill size + 0.0001 min to drill size + 0.0005 max. Made for drill sizes from 0.052 to 0.500.

Penn Engineering & Manufacturing Corp, Doylestown, Penna

Chemical cutting solution, Kem-Cut, is said to have very high heat conductivity, and extreme pressure characteristics for high anti-weld properties. Water-extended solution reportedly will not rust metals.

Park Chemical Co, 8074 Military Ave, Detroit 4, Mich

Tow truck, hydraulic, 3-wheel Tow-Bear, is now equipped with dual controls which allow operator to start or stop machine while walking along either side, as well as when riding.

Hudson House, Inc, Tow-Bear Div, 401 S E Water St, Portland Ore

Compression Molding Machine Is Completely Automatic

Automold, said to be low in price, requires only initial adjustment, occasional refilling with raw material, and removal of finished product.

Unit, with a 4-sec cycle, can process any thermosetting material, including fast-curing alkyds. Available in capacities of 25 and 50 tons.

Automatic Molding Machine Co, 3217 Exposition Pl, Los Angeles 18, Calif

Floor patching material, designated 45 Patch, can be applied over wet surfaces, is said to be highly resistant to oil, grease, acids, and alkalis. Powder is mixed with water; repaired surface can be used within 24 hours. Material forms permanent bond with existing floor area, can be painted over, reportedly will not chip or crack.

Colonial Refining & Chemical Co, 817 NBC Bldg, Cleveland 14, Ohio

Casters, designated Milspec, engineered to meet military specifications, are available in 8, 10, and 12-in. sizes. Heavy-duty units support up to 950 lb at towing speeds up to 20 mph. Second group, with "Floating-Hub" design, provide shock absorbing features needed to handle fragile loads. Details in catalog MS-55.

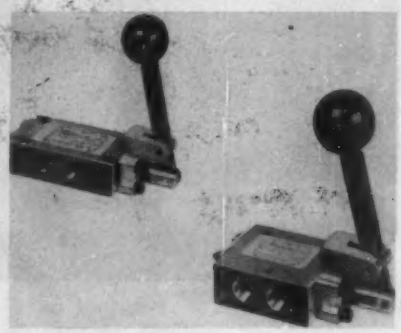
Bassick Co, Bridgeport 2, Conn

Cutting coolant, Hypercut XX, is a water soluble product containing Hyperoil, a super-lubricant additive. Especially recommended for machining of high hardness alloys; permits speed machining of 400, 500, and 600 sfm; compatible with all metals.

Destiny Products Co, 2970 W Grand Blvd, Detroit 2, Mich

Ceramic balls for applications requiring resistance to corrosion, abrasion, or high temperatures are available in a wide variety of synthetic and natural ceramic materials. Can be furnished in any standard or special size from ¼ to 4½ in. in large or small quantities.

Industrial Tectonics, Inc, Ann Arbor, Mich



CRV Hand Lever Valves

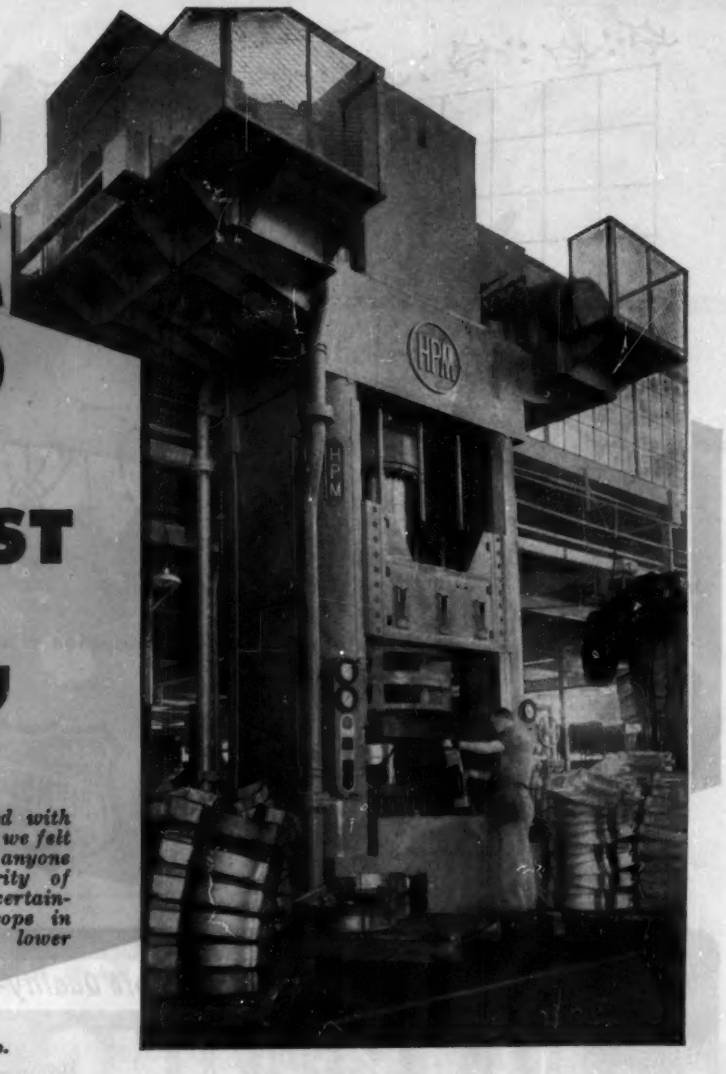
Two new 3 and 4-way lever-operated valves have been added to the CRV Series, designed for air or hydraulic control applications at working pressures to 200 psi.

Rectangular body design provides

"DEEPER DRAWS at LOWER COST with our H•P•M"

"We are very pleased with our H-P-M. For years we felt we could do as well as anyone on depth and severity of draw but H-P-M has certainly broadened our scope in this respect—and at lower costs."

Mr. Ralph F. Mueller
Exec. Vice President
General Metal Products Co.



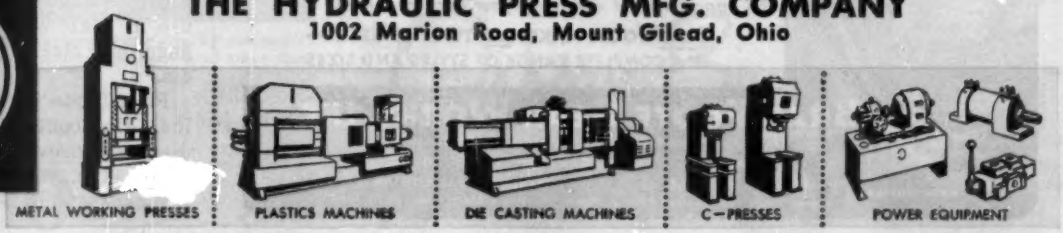
General Metal Products Reports Broadened Scope and Lower Costs with 700-ton H P M Hydraulic.

Take a tip from one of the midwest's largest metalworking specialists — H-P-M's will reduce costs for you, too. Whether it's drawing, forming, embossing, forging or other operations — large or small, deep or shallow, complex or simple — there's an H-P-M for the job. You'll find more and more work for your H-P-M with its fast cycle, all-hydraulic, automatic control and ease of die set-up. If obsolete equipment is hampering your production, call in the H-P-M field engineer for a close look at the most modern press equipment available. Broaden <u>your</u> scope with faster, more versatile H-P-M's.

Write today for Bulletin 5005.

HPM

THE HYDRAULIC PRESS MFG. COMPANY
1002 Marion Road, Mount Gilead, Ohio



"From the punch press department. Shows how production climbed this year with Columbia EXL-DIE!"

COLUMBIA TOOL STEEL COMPANY • CHICAGO HEIGHTS, ILL.

Producers of fine tool steels — All types immediately available through Sales Offices, Warehouses and Representatives in Principal Cities.

TOOL COLUMBIA STEELS

Another of the Reasons Behind Brad Foote Quality—

DEBURRING

• Deburring of gears isn't normally included in specs or drawings. And we don't get paid for it. But here at BRAD FOOTE we take pains and expend many man hours on deburring—for we know that one tiny burr can ruin a $100,000 machine.

• Examine your next shipment of gears. See whether your present supplier is painstakingly removing all the burrs. Find out how many hours your assembly department has had to charge against deburring. See another way in which BRAD FOOTE quality and extra attention to details saves you money.

• Prove to yourself the savings that BRAD FOOTE quality can mean. Let us quote on the gear requirements for your next program—whether it be radar equipment, diesel engines, etc. BRAD FOOTE has experience in providing gears for almost every specialized application and would welcome the opportunity of discussing your gear problems.

BRAD FOOTE MAKES ALL TYPES OF GEARS—
IN A COMPLETE RANGE OF STYLES AND SIZES

BRAD FOOTE GEAR WORKS, INC.
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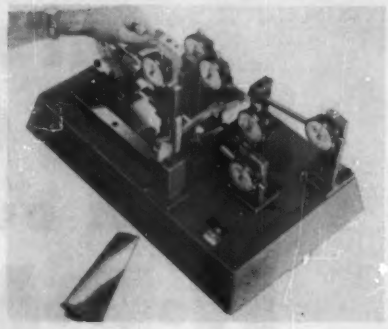
subsidiaries | AMERICAN GEAR & MFG. CO. Lemont, Illinois Phone Lemont 920 | PITTSBURGH GEAR COMPANY Phone SPalding 1-4600 Pittsburgh 25, Penn.

flat surfaces on all sides for compact mounting. Easy access to ports (⅛ in.-27 NPT) simplifies piping. Valve body is ¾ in. thick, ½ in. wide, and 3 13/16 in. long over-all on 3-way valves, 4⅝ in. on 4-way. Design incorporates a single sliding spool with standard O-ring seals throughout.

Also available in palm button, foot lever, roller, cam, or pilot-operated types.

Modernair Corp, 400 Preda St, San Leandro, Calif



JET ENGINE COMPRESSION BLADES are checked by dial indicating gage designated Model 259 B-158. Blade thickness is measured at six different points simultaneously. Multiple-dimension gages are available in series, each gage of which checks a different-size blade — *Federal Products Corp, 1144 Eddy St, Providence 1, R I*

Low-Viscosity Resin

EPON 815 is low-viscosity (500-900 centipoises) structural resin recently added to Shell Chemical's series of resins. Product is reported especially useful in laminates prepared by the contact pressure and vacuum-bag techniques, giving glass contents as high as 60% and 70% respectively.

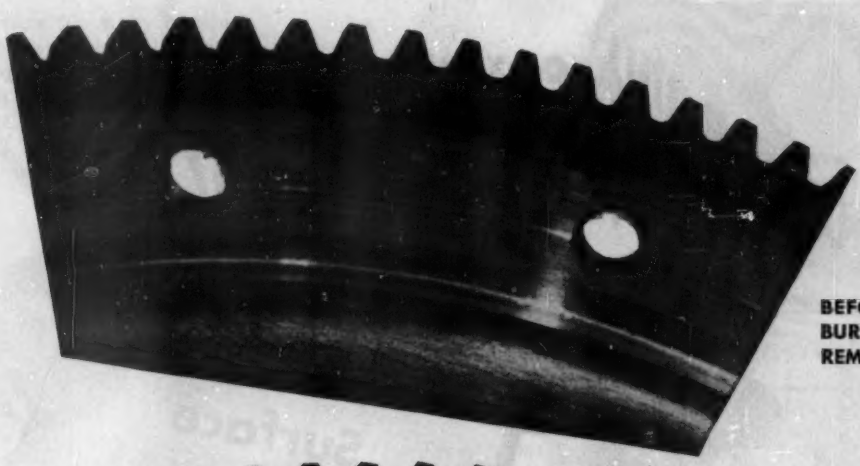
Resin is also adaptable to castings and adhesive applications, where its high filler content is said to permit better control of exothermic heat and shrinkage.

Shell Chemical Corp, 50 W 50th St, New York 20, NY

Electrodes, Welding Wire

Ampco-Trode 10 electrodes have 5/64-in. diameter, are designed for use in braze-welding of 16 and 18-gage mild steel with metal-arc process.

Phos-Trode wire having 8% nominal tin content is available in diameter sizes of 0.045, 1/16, 5/64, and 3/32 in. Wire is wound on spools and packaged in 25-lb cartons. Maker



BEFORE BURR REMOVAL

AFTER BURR REMOVAL

Removing burrs for trouble-free transmissions

One of many automatic brushing setups used by automotive manufacturers to finish transmission parts and other components.

BURRS left on automatic transmission parts can break loose in service, clog hydraulic lines and cause serious damage.

The two sections of a transmission cover shown above prove how thoroughly power brushing removes burrs and blends surface junctures . . . leaves the part smooth and clean.

Have an **O**sborn **B**rushing **A**nalysis made of your operations. It costs you nothing, but may save thousands of dollars in your finishing of parts. Write *The Osborn Manufacturing Company, Department C-40, 5401 Hamilton Avenue, Cleveland 14, Ohio.*

Osborn Brushes

OSBORN

BRUSHING METHODS • POWER, PAINT AND MAINTENANCE BRUSHES
BRUSHING MACHINES • FOUNDRY MOLDING MACHINES

New! Revolutionary!

Colonial
ONE-WAY
Surface
Broacher

"Eliminates" Return-Stroke
"Eliminates" End of Stroke
"Doubles" Length of Stroke

For complete information on the new Colonial ONE-WAY surface broacher, ask for Bulletin VC-55.

MECHANICAL DRIVE
AC MOTOR
VARIABLE SPEED
HYDRAULIC OR
MECHANICAL FIXTURES
CARBIDE OR
HSS BROACHES
NO PIT REQUIRED
FOR LOW CEILING
LONGER TOOL LIFE

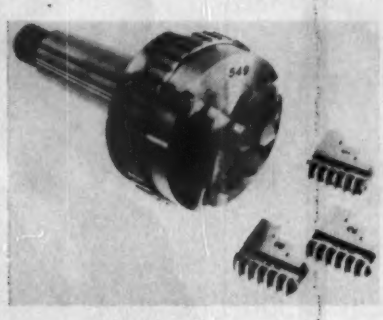
EXTREME ACCURACY
GUARANTEED
STROKE LENGTH
UP TO 200 INCHES
SPEEDS UP TO 50 FEET/MIN.
ONE LONG STROKE—
ONE PART
OR
MULTIPLE SHORT STROKES
ON MULTIPLE PARTS
CONTINUOUS OPERATION

PIONEERS OF H.S.S. BROACHING
COLONIAL
BROACH & MACHINE CO.
DETROIT 13, MICH.

UNIFIED BROACHING is the key to successful broaching

recommends wire for many bearing and corrosion-resistant applications, as well as for joining copper, tin bronzes, brasses, cast iron, and dissimilar metals.

Ampco Metal, Inc, 1745 S 38th St, Milwaukee 46, Wis.



Precision 3-Jaw Chuck

Swedish-made Jungner 3-jaw chuck is guaranteed to have a repetitive accuracy to 0.0001 in. Designed primarily for instrument and laboratory work, unit comes with two sets of jaws and has a built-in drive pulley.

Capacity is from 1/16 to 3 in. Shank is No. 4 Morse and has ⅜-in. hole through it.

Nife, Inc, Copiague, LI, NY

Microflat Black Granite Plates Have T-Slotted Surfaces

T-slot, fabricated from mild steel, inserted in Microflat, is recommended for special jobs where jigs, fixtures, and precision instrument applications are used.

T-slot plates are furnished with no clamping ledges, or two clamping ledges, always parallel to the T-slot. Available in sizes up to 72 x 144 in., plates can be finished down to 0.000050 in. per in.

Collins Microflat Co, 2326 E 8th St, Los Angeles 21, Calif.

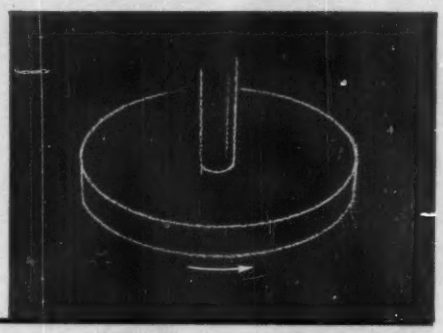
Wales Tube-Piercing Units For Press Brakes, Punch Presses

Double-acting tube-piercing units have many applications in fabricating such products as tubular furniture, aircraft components, and others where single or multiple holes are required in tubular parts. Capacities of standard units are ½ to 1-in.-OD tube; maximum punch diameter is 0.312 in., maximum wall thickness of tubing 0.093 in.

Alignment of upper and lower sections is obtained by applying a straight edge to the surfaces tof the adapter plates which fit over the

(Continuel on page 184)

HOLCROFT and the ROTARY FURNACE



high production in small space

Production rates frequently bog down when floor space limitations prohibit large equipment purchases.

That's why—when the problem is heat treating—many companies turn to Holcroft for answers. Experience—imaginative engineering—versatility of products—all team up to provide answers.

For example, the solution to the problem above could conceivably be a rotary furnace; with one or two doors for loading and unloading and a rotating hearth which carries the stock through the heat treat cycle. The hearth can be of a heat-resistant alloy or a refractory material—can be suspended from above or supported from below. Rotary furnaces can be tunnel-type, grid-type, drum-type, or rotating retort.

Of course, this is only one of the many kinds of stock handling which might be suggested by Holcroft. Your problem probably will be different and Holcroft will have the answer.

Write today for a copy of Holcroft's illustrated book: "Blazing the Heat Treat Trail." It's bound to give you food for thought.

4875

HOLCROFT AND COMPANY

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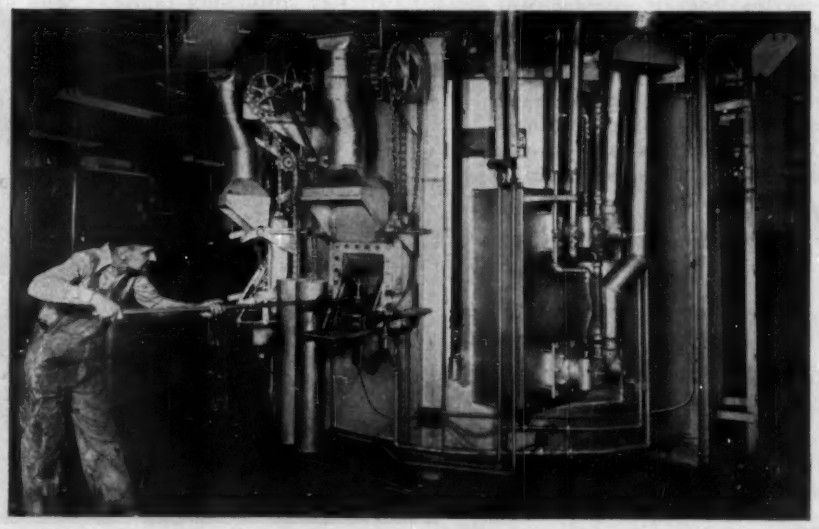
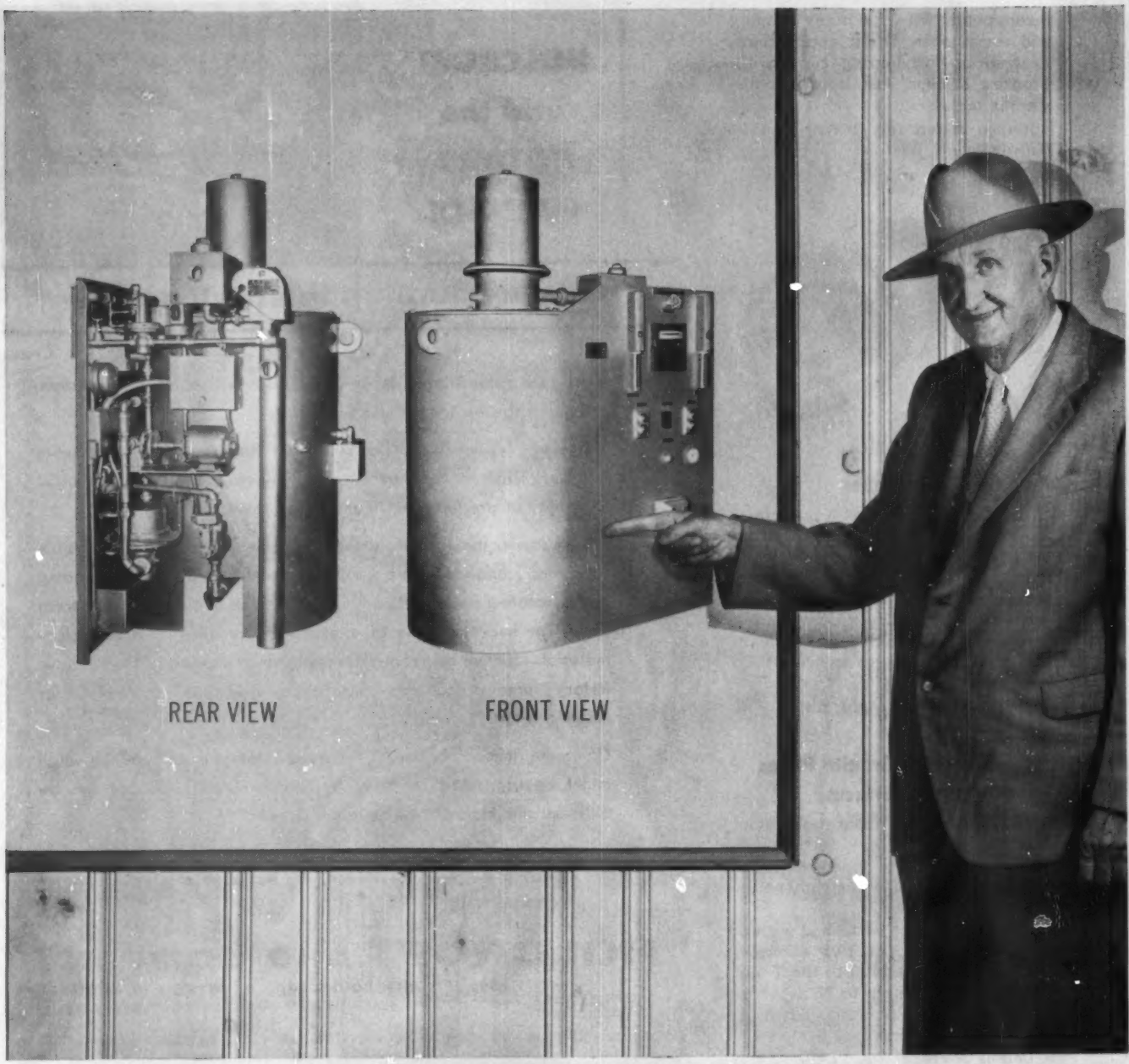
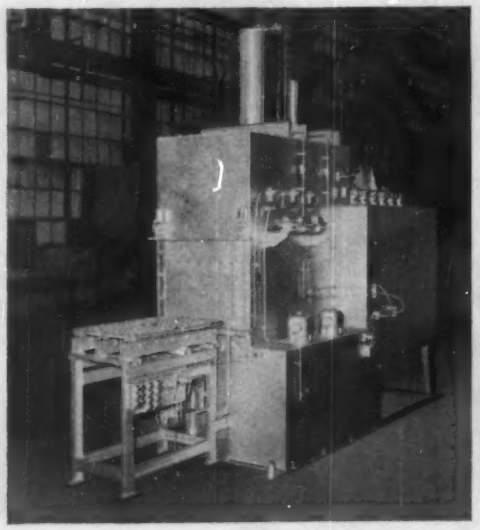
PRODUCTION HEAT TREAT FURNACES FOR EVERY PURPOSE

CHICAGO, ILL. • CLEVELAND, OHIO • DARIEN, CONN. • HOUSTON, TEXAS • LOS ANGELES, CALIF. • PHILADELPHIA, PA.
CANADA . Walker Metal Products, Ltd., Windsor, Ontario





New Endogas generators match the complete Westinghouse line of toolroom furnaces from box-type (right) to multi-purpose (left).



Claud S. Gordon unveils

Westinghouse new Endogas® generator

For atmosphere flexibility over the entire range of Endogas to Exogas®

Now, with only one atmosphere generator, you're able to produce the complete range of atmospheres available from any fuel gas. Actually this new Endogas generator can help you expand production. For example, it is easily adjusted to supply several furnaces, one at a time, with atmospheres for either annealing, tempering, clean-hardening, brazing, sintering or gas carburizing.

After considering these operating advantages and the trim, functional design of this new unit, look at these important laborsaving features, too. The Endogas generator is shipped completely assembled, ready for easy installation. Maintenance is quick and simple. The removal of a few bolts from the flanged retort cap exposes the heating chamber and retort for quick inspection of the catalyst. For accurate atmosphere analysis and control, a mixing pump and balancing regulator automatically maintain gas pressure and ratio.

But to get the full story of the new Endogas generator, call any Claud S. Gordon Company representative. In areas where you cannot reach him, call the local Westinghouse Sales Office, or write Westinghouse Industrial Heating Division, Meadville, Penna.

J-10446

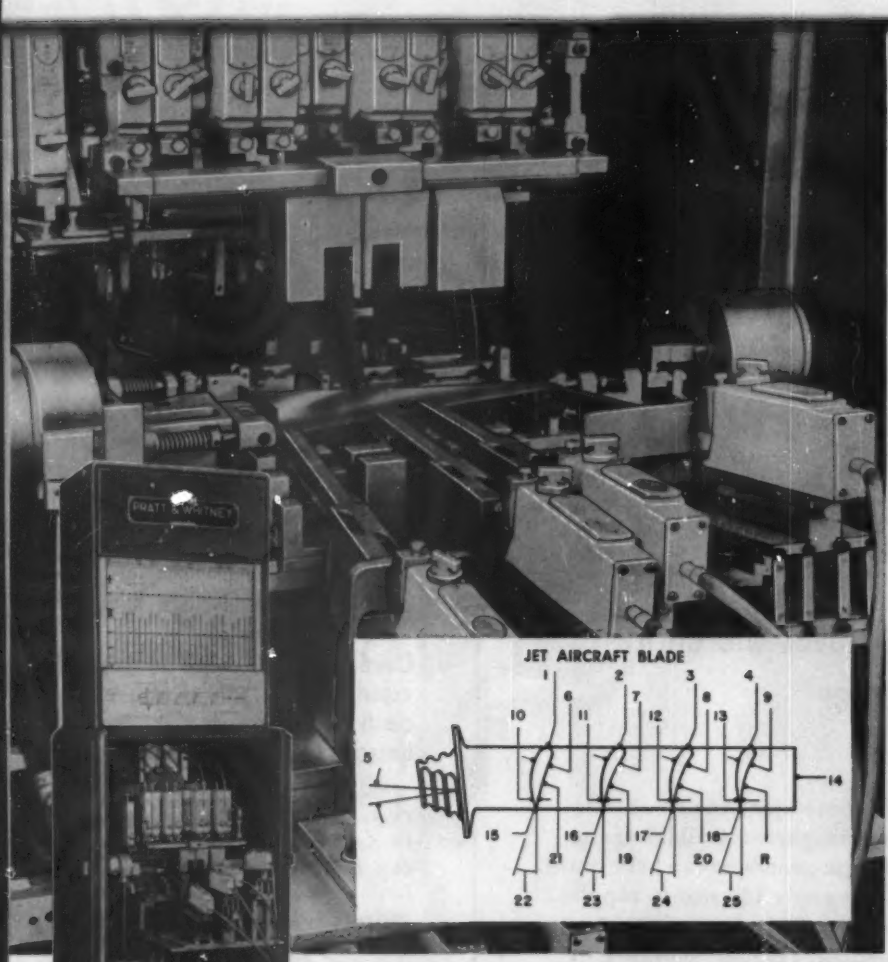
YOU CAN BE SURE...IF IT'S Westinghouse

"Heat-treating answers are our business."

Claud S. Gordon tells why his broad experience and facilities back, exclusively, the complete Westinghouse toolroom furnace line.

Our company is now approaching its forty-second year of helping customers improve heat-treating facilities. During this time our experience in applying all types of furnaces has given us an appreciation for the sound design and engineering of Westinghouse equipment. We look forward to passing on to you the many improvements in the Westinghouse toolroom furnace line and plan to tell you more about the developments still in test stage.

In addition, the Claud S. Gordon Company will continue the manufacture of thermocouples, insulated wire and other thermocouple supplies, as well as pyrometers. Our competent sales force averages 10 years' experience per man. Any of these engineers are capable of complete responsibility for installation of the right Westinghouse toolroom furnace, control and testing equipment for you. Thus we assure you of a complete job from engineering to installation. Claud S. Gordon Company, 3000 S. Wallace Street, Chicago, Illinois.



GAGE
many dimensions...
rapidly, accurately

PRATT & WHITNEY
SIGMATIC
GAGING MACHINES

25 CRITICAL DIMENSIONS of jet engine compressor blades are checked simultaneously on this P&W, Semi-Automatic Type, SIGMATIC Gaging Machine. Gaging is fast (up to 350 blades per hour), low in cost and dependably accurate. By contrast, separate gaging of each dimension would be slow, prohibitively expensive, and subject to the element of human error.

Like all SIGMATIC Gages, this machine is versatile . . . able to check several different blade sizes by means of interchangeable gage tooling; changeover takes only about 30 minutes.

For large or small production runs . . . for in-process gaging or final inspection . . . *wherever* many dimensions of complex parts must be closely controlled, P&W SIGMATIC Gaging provides the practical, low cost answer. Use the coupon on the facing page to send for complete information; there's a machine *right* for your needs.

PRATT & WHITNEY COMPANY
INCORPORATED
11 Charter Oak Boulevard, West Hartford 1, Connecticut
Direct Factory Representatives in Principal Cities

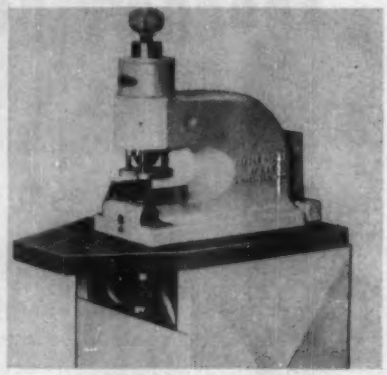
MACHINE TOOLS • GAGES • CUTTING TOOLS

tubing in the punch. Because there is no die in the unit, danger of shearing the punches through misalignment is eliminated.

Units can be set up on flat plates for mounting to bolster and ram plates of punch presses. Keyed plates for mounting individually in press brakes can also be furnished. For a series of holes, templets can be supplied.

Special units for larger holes and larger tubing are available.

Wales-Strippit Corp, 345 Payne Ave, North Tonawanda, NY



Dayton-Rogers Piercing Press Is Fully Automatic

Machine for producing pierced holes in stamped blanks is fully automatic, pierces holes from 0.015 in. up to 1¾ in. in small lot production. Work cycle of the press allows machine to run at its maximum speed, giving from 200 to 300 strokes per minute.

Holes to be pierced in various stampings can be handled in thicknesses from 0.005 to 3/16 in. Machines can be grouped in semi-circular fashion for production of parts containing different-size holes.

Dayton Rogers Mfg Co, Minneapolis 7, Minn

Mastic Washer and Gasket Cold Flows Under Pressure

Washer and gasket cold flows into any annular space or void when pressure is applied, providing a positive, close-fitting seal. Amount of flow is controlled by amount of material in washer or gasket, predetermined by matching right size and shape to particular job.

Advantages claimed: excellent adhesion to metal, glass, and plastic; will not get brittle or shrink, crack, or lose adhesion at temps from 375 to -40 F; will not stain or bleed, can be painted over immediately.

Presstite Engineering Co, 3796 Chouteau Ave, St Louis 10, Mo

Milling Cutters Ground After Hardening

Swedish automatic machine grinds the final shape of contour milling cutters after hardening. Machine can produce large or small quantities of identical cutters with any tooth shape except those containing concave curves of less than ⅜ in.

Cutters can be resharpened on the face of each tooth without changing the established contour.

All cutters are available with chip clearance on the sides as well as the tops of the teeth. Standard size blanks are available in widths from ⅛ in. to ¾ in., and diameters from 2¼ in. to 4 in.

Homestrand, Inc, Larchmont, NY

Texaco Soluble Oil HD Has Extreme Pressure Additives

Soluble HD is a water-emulsive cutting fluid which is said to give the extreme-pressure characteristics of sulfurized cutting oil, combined with the cooling effect of water. According to the manufacturer, the base mixes readily with temperate water, hard or soft, to give a stable emulsion with rust inhibiting properties. Said to be suitable for such operations as cutting, boring, broaching, and carbide-tool machining in automatics.

The Texas Co, 135 E 42nd St, New York 17, NY

Truck Leveling Device

Adjust-A-Truck unit is built into the pavement in front of a loading dock. Heavy-duty hydraulic system raises or lowers truck or trailer until bed of vehicle is even with the dock.

Capacity is 40,000 lbs; standard units measure 12 ft long, with choice of 9 or 10-ft widths. Unit can be raised or lowered with vehicle on its platform, or trucks can be driven onto it without prior adjustment. Ramp is positioned by pushbutton control.

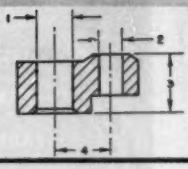
Rowe Methods, Inc, 2534 Detroit Ave, Cleveland 13, Ohio

Coolant Clarifier for Industrial Filtration

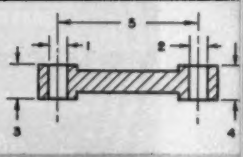
U. S. Hoffman coolant clarifier, know as Roto-Flo 15 Magna Grip, is magnetic-separator unit designed for automatic cleaning of machine tool coolants. Unit requires no floor space, mounts directly on existing coolant tank facilities or on any part of machine.

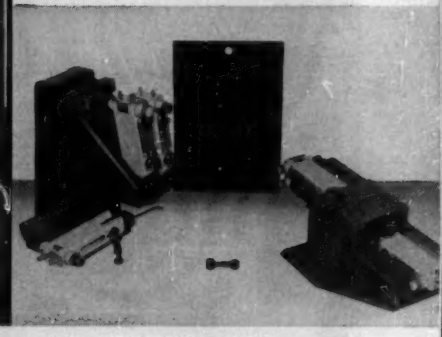
Clarifier is constructed so that coolant flow is always in contact with a permanent magnetic drum

SEWING MACHINE PART



SMALL CONNECTING ROD





GAGE a variety of parts with quickly interchangeable gage tooling

Checking many dimensions of parts simultaneously, multi-dimensional gaging *is potentially* the answer to today's production gaging problems. But *only* P&W SIGMATIC Gaging Machines offer the versatility and adaptability that make the time and cost saving advantages of multi-dimension gaging available for checking a wide variety of parts . . . for short *and* long production runs.

ALL SIGMATIC MACHINES ARE ASSEMBLED FROM STANDARD UNITS Conversion to other gaging needs is simple, economical. Quotation, engineering, production and shipment to you are greatly facilitated.

GAGE TOOLING IS QUICKLY INTERCHANGED When production of one part is ended or shifted to another part . . . simply re-tool. The SIGMATIC Machine illustrated here, for example, is equipped with 3 sets of interchangeable tooling to check a sewing machine part, an engine tappet and a small connecting rod. Tooling change-over takes only 20 minutes. Operation is semi-automatic; rate of inspection is 600 parts per hour; on each of the 3 parts, 5 critical dimensions are checked.

Manual, semi-automatic or fully automatic . . . checking up to 50 dimensions . . . inspection rates to 5000 pieces per hour . . . handling virtually any size, weight or shape of part . . . there's a P&W SIGMATIC Gaging Machine to check *all* your production parts—today *and* tomorrow. For complete information, use the attached coupon to send for Circular No. 592.

PRATT & WHITNEY
SIGMATIC
GAGING MACHINES

PRATT & WHITNEY COMPANY, INCORPORATED
11 Charter Oak Boulevard • West Hartford 1, Connecticut
Please send my free copy of P&W Circular No. 592.

name_____ title_____

company_____

co. address_____

city_____ zone_____ state_____

SCREWDRIVING

on production or maintenance work

for manual or power tool operation

you can do it better with APEX

APEX has these tools to help you:	if you drive these types of screws; PHILLIPS	FREARSON (Reed & Prince)	SLOTTED	CLUTCH HEAD	SOCKET HEAD
POWER BITS	X	X	X	X	X
HAND DRIVERS	X	X		X	
FEMALE SQUARE DRIVE BITS	X	X		X	
HAND BRACE BITS	X	X		X	
OFFSET DRIVERS	X	X	—		
FINDER SLEEVE ASSEMBLIES			X		
INSERT BITS AND BIT HOLDERS	X	X	X	X	X
COMBINATION HAND DRIVERS	X	X	X	X	X
HAND BRACE BIT HOLDERS	X	X	X	X	X
FEMALE SQUARE DRIVE BIT HOLDERS	X	X	X	X	X

There are Apex screwdriving tools to fit all well-known makes of air, electric or spiral drivers . . . standard and magnetic bit holders . . . shanks and reversible sockets for use on hex head sheet metal screws. Complete information will be found in our Catalog 21—the authority on screwdriving; write, on your company letterhead please, for your copy.

APEX screwdriving tools

THE APEX MACHINE & TOOL CO.
1026 Patterson Blvd. • Dayton 2, Ohio

as it passes through the unit. Drum speeds may be varied to suit different types of coolants.

Coolant, upon leaving machine, passes under revolving drum of solid Alnico, which is permanently charged. Drum, revolving against coolant flow, attracts ferrous materials in the coolant; separated material is removed from drum by a non-magnetic scraper and deposited in a sludge pan.

Unit is driven by a 1/50-hp worm-gear speed-reducer motor equipped for 110-v, 60 cycle current. Motors equipped for 220 or 440-v operation are also available. Motor-driven wringer synchronized with a drive motor is furnished as standard equipment. 108-lb unit is 28 in. long, 23 in. high, and 10¼ in. wide.

Industrial Filtration Div, U S Hoffman Machinery Corp, 105 4th Ave, New York 3, NY

Redesigned Rotary Air Pumps Have Less Height, More Vacuum

Reduction of 33% in over-all height and an increase in vacuum to as low as 0.4 mm mercury absolute has been achieved in Leiman Bros redesigned line of straight wing rotary air pumps. Units range in capacities from 2.4 to 40 cfm.

Improvements are the result of repositioning of the automatic oiling system, now placed under the pump instead of on top. Redesign does not affect length of steel wings, area of piston space or efficiency of the automatic wing adjuster in the pump itself. When used for pressure, units provide range of 15 to 20 psig.

Leiman Bros, Inc, 102 Christie St, Newark 5, NJ

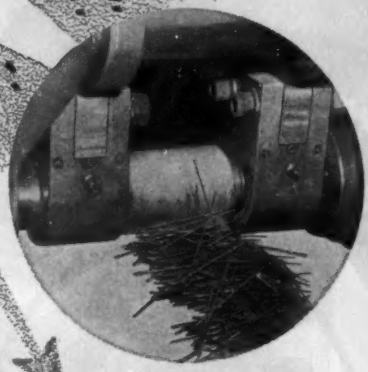
Guide Attachment For Semi-Automatic Welders

Portamatic Pacer, guide attachment for semi-automatic welders, has controls for setting speed and height, so that operator does not have to move the cone at an even speed and at a constant height. 3½-lb unit is made of aluminum, stainless steel,

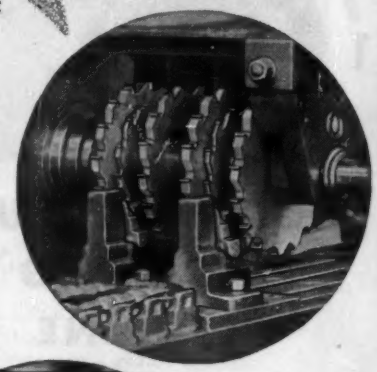
city_____ zone_____ state_____

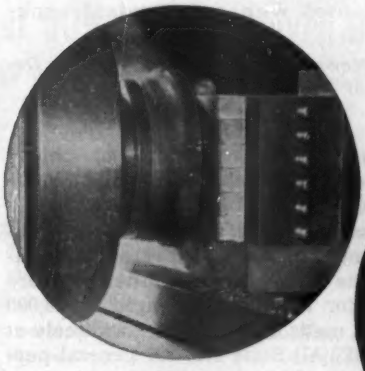
HERE'S THE "Payoff Point" ON ANY MACHINE!

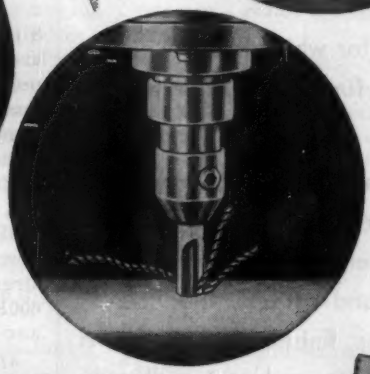
Production speed, product quality and economy depend on one single factor—THE TOOLING IN THE MACHINE!



Nelco carbide tipped tools make *any* machine tool more efficient, more productive. On a new machine, Nelco tools give *maximum performance.* The tool, and be sure it's Nelco, is the PAYOFF POINT on any machining operation. Nelco tools are built to cut—and keep on cutting—to close tolerances and schedules. Finishes are finer; downtime reduced; a size and type for every job a proven fact. For that extra edge in production in new machine or old, look to Nelco at the PAYOFF POINT.







SEND TODAY FOR THE NEW NELCO CATALOG—over 850 standard cost *cutting*, time *cutting* carbide tools.

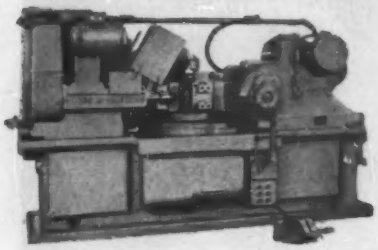
NELCO TOOLS

- FACE MILLS
- SLAB MILLS
- BORING BARS
- SPECIAL TOOLS
- SLITTING SAWS
- HALF SIDE MILLS
- KEYSEAT CUTTERS
- DIAMOND WHEELS
- SHELL END MILLS
- TRI-HELIX FACE MILLS
- HARDENED STEEL DRILLS
- FINE PITCH FACE MILLS
- SOLID CARBIDE REAMERS
- CARBIDE TIPPED TAPER SHANK CHUCKING REAMERS
- CARBIDE TIPPED STRAIGHT SHANK CHUCKING REAMERS
- 2 FLUTE DOUBLE END SOLID CARBIDE END MILLS
- 4 FLUTE DOUBLE END SOLID CARBIDE END MILLS
- 3 FLUTE CARBIDE TIPPED CENTER CUTTING END MILLS
- SOLID CARBIDE TWIST DRILLS
- No. 50 TAPER SHANK END MILLS
- INSERTED BLADE FACE MILLS
- GRINDER AND LATHE CENTERS
- CARBIDE TIPPED TWIST DRILLS
- TRI-HELIX SIDE MILLING CUTTERS
- 2 FLUTE CARBIDE TIPPED END MILLS
- 2 FLUTE SOLID CARBIDE END MILLS
- 3 FLUTE CARBIDE TIPPED END MILLS
- 4 FLUTE CARBIDE TIPPED END MILLS
- 4 FLUTE SOLID CARBIDE END MILLS
- TYPE C SHELL MILLING CUTTER ARBORS

NELCO TOOLS

For that EXTRA Edge in Production!

NELCO TOOL CO., Inc. • Manchester, Connecticut



GOSS and DE LEEUW
CHUCKING
MACHINE

When any of the various functions for which this machine is designed are performed on it, no further machining is required. The job is finished.

The basic "1-2-3" method—exclusive with Goss & DeLeeuw—provides for gripping work in the chuck and machining all ends either simultaneously or in sequence. By eliminating several handlings and set-ups, the "1-2-3" method produces finished pieces at a fraction of the time and cost ordinarily required.

Send samples of your work for time estimates. Ask for illustrated literature containing detailed information.

GOSS & DeLEEUW
QUALITY PRODUCT QUANTITY

GOSS and DE LEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

and brass, and is equipped with a sealed dc aluminum motor controlled by an inch button on the handle.

Stainless steel non-magnetic 3½-in. guide wheel rolls attachment on a smooth, continuous bead. Second wheel is provided for additional support for fillet welds and clearance over tack welds.

Stepless dc control box built for welding speeds up to 80 ipm and geared for precision adjustments is provided. 7½-lb box can be mounted on any wire feed mount.

Carlson Mfg Co, 195 W Carson St, Pittsburgh 19, Pa

Steel cabinets for storage of fine tools, delicate instruments, dies and spare parts are available in four types: double door, single-door, desk-, or counter-high models. Standard 6½-ft, tamper-proof unit can hold as many as 16 adjustable shelves placed 4 in. apart.

Standard Pressed Steel Co, Jenkintown, Penna

Penetrating oil, trade-named Bear, is said to be fast-acting, with lubrication, rust-prevention, and extremely high flash-point properties. Loosens frozen and rusted metal parts in minutes; gives long protection, according to manufacturer; may be used with any standard applicator.

House of Laurila, 18483 Braile, Detroit 19, Mich

Silver alloys for welding operations are designed for use in joining aluminum, copper, brass, bronze, stainless steel, steel, monel, and combinations of these or other metals. All-State No. 105 medium-temperature solder has shear strength of 18,000 psi, melts at 675F and flows freely at 750F. All-State No. 107 general-purpose solder has 20,000 psi shear strength, melts at 450F and flows at 600F. Recommended for lap, sleeve, and socket-type joints.

All-State Welding Alloys Co, 249-55 Ferris Ave, White Plains, NY

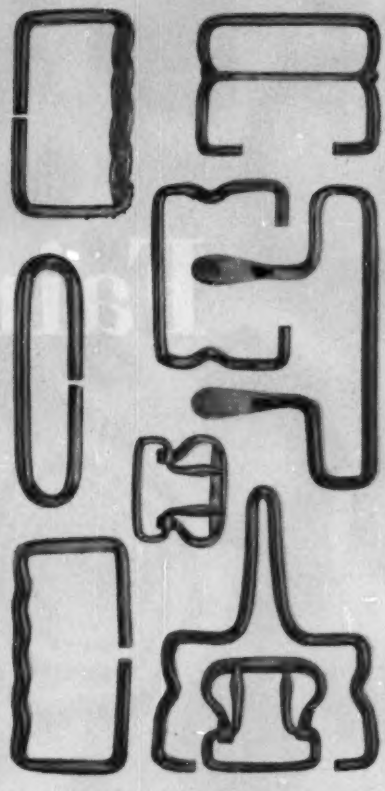
Lead Bearing Steel Plate

Ryerson's New E-Z-Cut is said to have a number of advantages compared with plate which depends on addition of sulphur to provide free cutting quality.

These include: improved machinability, and superior welding, polishing, and plating properties. Its flame-cutting, forming, grinding, and

(Continued on page 192)

Anaconda Wire now available in New Pay-off Container



BUCKLES AND BUCKLE PARTS made by West Haven Buckle Co., West Haven, Conn., using Anaconda 70-30 yellow brass wire. Finished buckles, later nickel plated, are of highest quality, noncorroding, for use in surgical bandages, trusses, corsets and other surgical appliances.

Shutdowns to change coils in wire forming machines cut 90% at West Haven Buckle Company

The West Haven Buckle Company of West Haven, Conn., used to be limited to relatively light coils of brass wire because of the slide feed necessary for free pay-off into its wire forming machines. Machines could operate less than an hour before shutdown to feed in another coil.

When they started using Anaconda Wire packaged in the *new pay-off barrel*, which provides free pay-off, the runs were increased 10 times. The big coils of brass wire—400 to 500 pounds—made possible continuous runs of from 8 to 9 hours. This cut the time lost in changing coils 90 per cent. It eliminated the labor of shifting and lifting heavy coils—as the wire is fed directly from the barrel.

An easy way to increase production, cut costs: Big coils of Anaconda Wire in the *new pay-off barrel* give you these advantages:

1. Reduced down-time to change coils can mean production increases up to 25 per cent. Free pay-off feature may enable you to increase machine speed for still greater production.
2. Operators are freed for other duties during the longer continuous runs.
3. Easier handling, better inventory control. Barrels are clearly marked for quick identification—are easily handled by standard hand trucks—utilize storage space efficiently—can be stacked. Losses are minimized because coils stay clean indefinitely—there is no danger of coils becoming tangled or mixed.

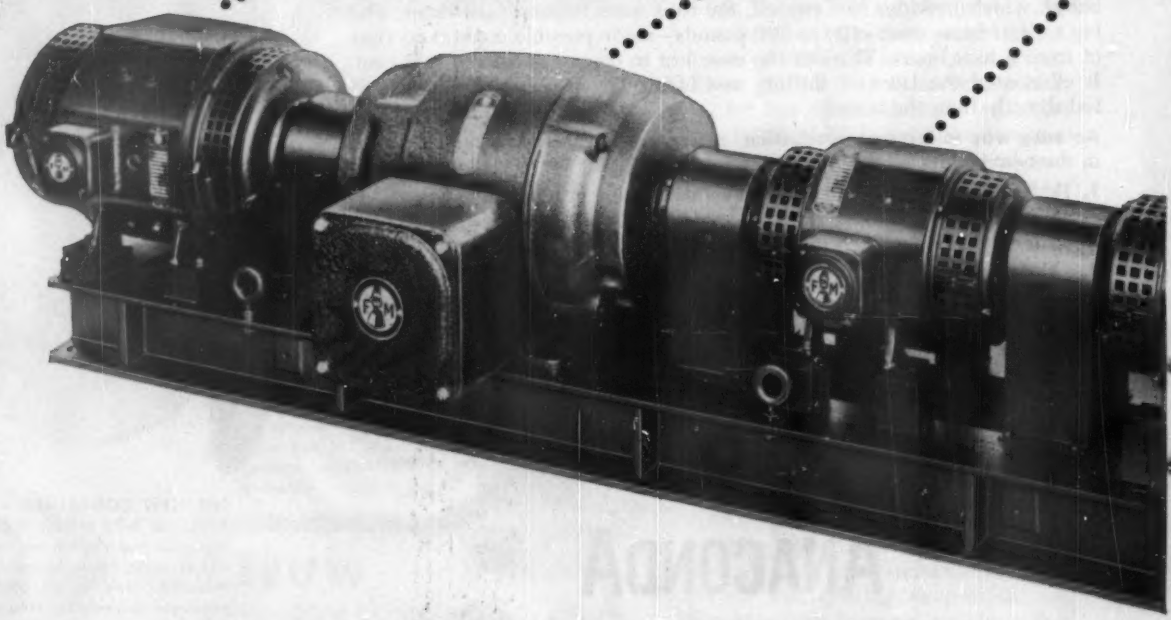
No extra charge for Anaconda Wire in the new pay-off container. Call your American Brass Company representative today or write: The American Brass Company, Waterbury 20, Conn. 8685

THE NEW CONTAINER which provides Anaconda Wire in 400 to 500 pound coils, ready for free pay-off into pin machines and other automatic forming machinery. Anaconda wire in all alloys is available packaged this way for long, continuous runs—in all gages up to .090", in tempers at least one number hard.

ANACONDA®

COPPER AND COPPER ALLOY WIRE

Fairbanks-Morse power source for Electronic



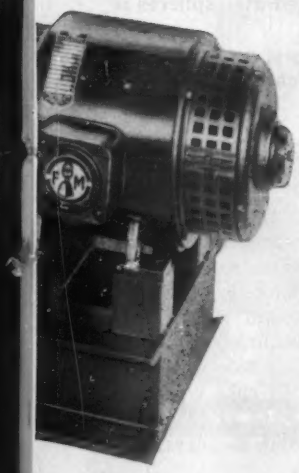
computer

the point is

. . . when a well-known electronics firm needed a D.C. power supply, with extremely special electrical characteristics for a new design of electronic computer, they turned to Fairbanks-Morse for Experienced Application Engineering.

More than a piece of electrical equipment, they wanted the plus of experience and product knowledge that brings a successful product out of the design stage to commercial reality.

When next your design problems involve electrical machinery—be it one or 10,000 horsepower—call on Fairbanks-Morse electrical experience. Fairbanks, Morse & Co., 600 S. Michigan Ave., Chicago 5, Ill.



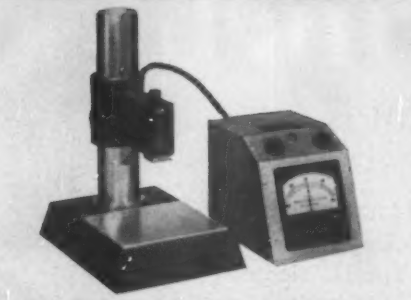
FAIRBANKS-MORSE

a name worth remembering when you want the best

ELECTRIC MOTORS AND GENERATORS • DIESEL LOCOMOTIVES AND ENGINES • PUMPS
SCALES • RAIL CARS • HOME WATER SERVICE EQUIPMENT • MOWERS • MAGNETOS

NEW

micro-comparator measures to .000001 inch without physical contact



- Amazingly compact—stand measures just 7" x 10" x 15".
- Ruggedly constructed for in-the-shop service.
- Sensitivity from .000001 inch to .00001 inch per division.
- Requires no special skills or training to operate.
- Uses capacitive gaging method for high sensitivity with either contact or no-contact type heads.

This combination of compactness, simplicity, and sensitivity has *never before been available* in a micrometer comparator of this type. You need only plug the unit into any 115V, 60 cy. line . . . balance the system with a master gauge in place . . . and you're ready to measure! Plus or minus variations in dimension are read directly from the meter scale. Highly sensitive for permanent use in the standards laboratory, it is still made rugged and simple enough for use as a working tool on the production line.

One of a new family of instruments based on the famous "T-42" Ionization Transducer, the Decker Micro-Comparator measures variation in dimension by detecting variation in capacitance, and expresses this capacitance change directly in a phase-sensitive d-c signal voltage.

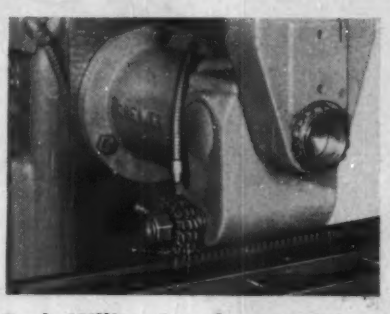
Complete information on this unique new instrument is in Data Sheet 103-1, available upon request to Technical Literature Section,

DECKER AVIATION CORPORATION
1361 Frankford Ave., Philadelphia 25, Pa.

decker

case hardening characteristics are said to be equally as good as those of the free machining plate which the company previously sold under the E-Z-Cut name. Plate is currently available from stock in thicknesses from ¼ to 3 in. inclusive.

Joseph T Ryerson & Son, Inc, PO Box 8000-A, Chicago 80, Ill



Rack Milling Attachment

Designed for operations on Greaves horizontal milling machines, rack milling attachment consists of milling head which mounts by three bolts on column face of the milling machine. Axis about which cutter revolves is perpendicular to that of the machine's horizontal spindle.

Driven directly from machine spindle through spiral bevel gears, attachment operates at spindle speeds which are in 1:1 ratio with machine spindle speeds.

Attachment is supplied complete with special rack vise 36 in. long and with jaw opening of 5½ in. Racks of greater length may be milled by moving workpiece in the vise.

Greaves Machine Tool Div, J A Fay & Egan Co, 2011 Eastern Ave, Cincinnati 2, Ohio

Vibration mountings, Finnflex Type SB, consist of a cast semi-steel housing containing helical steel springs, rubber thrust bumpers, nylon dampers, and a steel base plate with sway control assemblies. Line consists of 41 standard sizes; rated load capacities from 100 to 6500 lb.

T R Finn & Co, Industrial Div, Hawthorne, NJ

Adjustable Drill Operates On Ball Bearing Principle

Trocki drill has two movable blades whose point is the center of arcs of two ball-bearing grooves in the adapter. Blades have twin holes to retain bearings which control them as they are swung in and out to cut different diameters, leaving drill points always on center. Adjustment is made by loosening clamping screws and setting spreading screw to size desired.

The 100% cutting point is said to make possible production of holes of different diameter with up to 1/3 the pressure of regular drills. Tool is available in sizes from ⅞ to 2 9/32.

Erie Precision Products Co, 1346 E 12th St, Erie, Pa

Molyfilm Lubricant

Molyfilm, for break-in running, wire drawing, tools, dies, threaded parts, and similar areas that are hard to lubricate, is said to produce surfaces which resist galling, seizing, abrasion, and very high pressures, as well as reduce friction.

The fine gray powder can be used as a lubricant itself, or as a type of lubrication prime coating. In the latter application it forms the base lubrication on parts normally oiled and greased. It is applied by rubbing, tumbling, or immersing. Film formed is microscopic, tenacious to metal, unaffected by temps up to 700 F.

Tower Oil Co, 300 W Washington St, Chicago 6, Ill

Stainless Brazing Alloy Paste

Nicrobraz stainless steel brazing alloy is now available in paste form for use in all types of applications involving stainless steels, nickel-base, cobalt-base, and similar alloys, as well as low alloy steels, carbon steels, and copper.

Reportedly produces a heat and corrosion-resistant brazed joint, and provides a thin corrosion-resistant overlay in area surrounding joint where protection is frequently required for low alloy steels. Applied by brushing, dipping, or any type of hand or mechanical application when properly diluted, product permits torch and induction brazing in applications where brazing under vacuum or controlled atmospheres is not feasible.

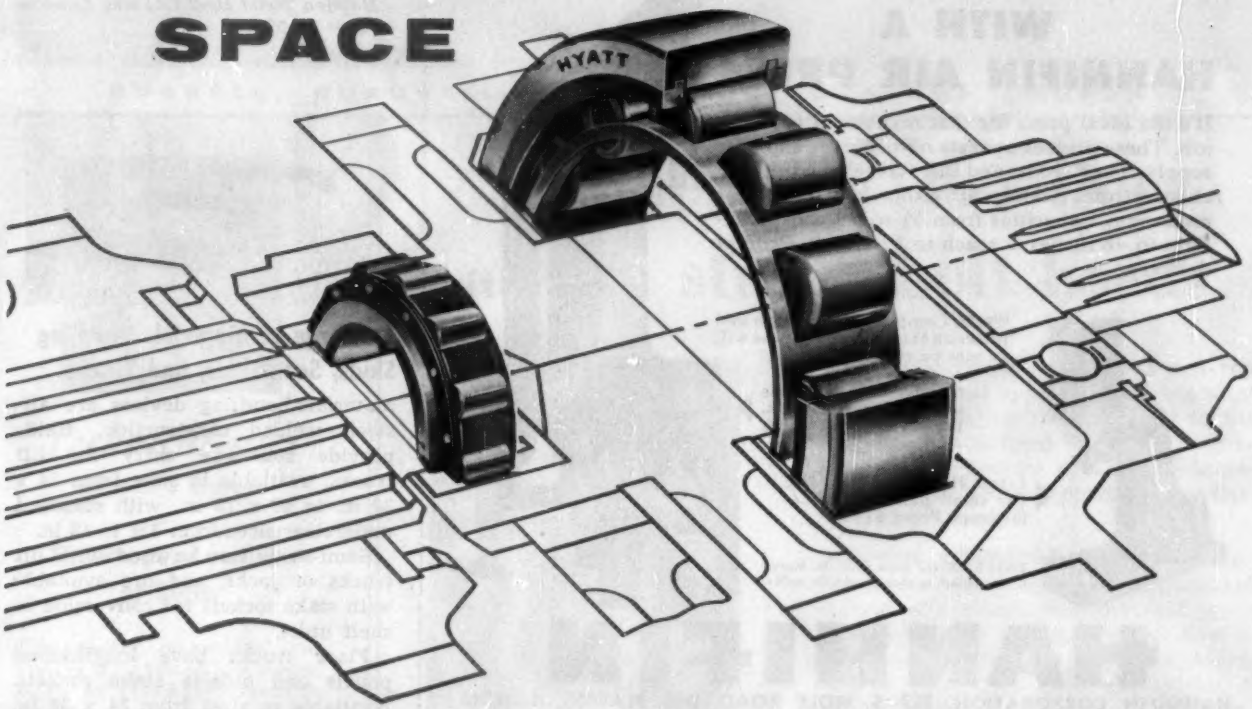
Wall Colmonoy Corp, Stainless Processing Div, 19345 John R St, Detroit 3, Mich

Drill Blank Set

Hayden set of drill blanks consists of series of drill blanks each 0.001 in. larger than the preceding, starting with 0.015 in. and ending with 0.500 in. Each blank is made of hardened and ground high-speed steel, ground to tolerance of +0.0002 in and –0.0000 in. All 485 pieces are assembled in wooden case weighing 60 lb.

Blanks can be used as gages, test

How Hy-Loads can help you ...SAVE SPACE



HY POTENUSE, the sage of the slide rule, SAYS:

your COMPLETE LINE of cylindrical roller bearings

Here's a tractor transmission where the designer's done a mighty fine job of cramming the whole works into a housing with dimensions tighter than McTavish's purse strings!

See how he did it? He used a HYATT BU-type Cylindrical Roller Bearing at the pilot position with the *outer race omitted.* Then on the input shaft he used a HYATT TS-type bearing with the *inner race omitted.* Gear-box size is held to a minimum with maximum bearing capacity! Hyatt makes 4 types of Hy-Loads with separable inner races and 2 types with separable outer races. And brother, they sure come in handy when you're cramped for space! If you haven't a HYATT General Catalog No. 150 handy, better send for yours right now. It'll help you find the answer to lots of pesky problems. Hyatt Bearings Division, General Motors Corporation, Harrison, New Jersey.

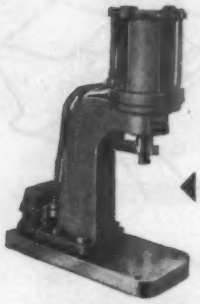
HYATT ROLLER BEARINGS

STRAIGHT BARREL TAPER

SAVE!

WITH A HANNIFIN AIR PRESS

It's the ideal press for that occasional pressing job. These presses operate off ordinary shop air supply. They're fast and safe. Over 30 models to choose from...many for either bench or floor mounting. Capacities from ½ to 18 tons. Daylight to 46 inches...reach to 12 inches. Prompt delivery.

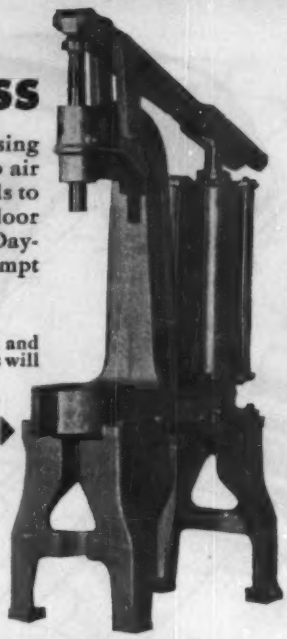


WRITE. Complete information and prices on Hannifin Air Presses will be sent on request.

6 Tons (Model B-2) One of more than 30 models. Press with base, $554.

1-ton Hand-D-Press. For small parts manufacturers. Press, $232.

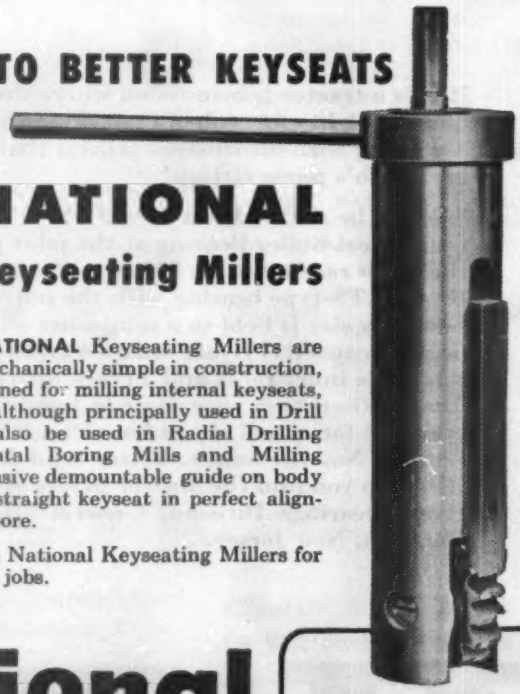
Prices F.O.B. our press plant, St. Marys, Ohio, subject to change without notice.



HANNIFIN

HANNIFIN CORPORATION, 517 S. WOLF ROAD, DES PLAINES, ILLINOIS

THE KEY TO BETTER KEYSEATS



NATIONAL Keyseating Millers

NATIONAL Keyseating Millers are mechanically simple in construction, sturdily built, designed for milling internal keyseats, faster and better. Although principally used in Drill Presses they can also be used in Radial Drilling Machines, Horizontal Boring Mills and Milling Machines. An exclusive demountable guide on body of Miller assures a straight keyseat in perfect alignment with axis of bore.

You can depend on National Keyseating Millers for all your keyseating jobs.

national

MACHINE TOOL CO.

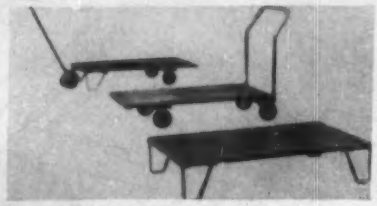
CINCINNATI 22, OHIO

WRITE TODAY

for Catalog No. 17 complete, handy size

bars, sine plate members, jig locating pins, radius gages, and index pins. In addition, they can be machined to produce cutting tools, mandrels, rollers, and other similar parts.

Hayden Twist Drill Co, 8626 Lyndon, Detroit 38, Mich



Marforge LC Materials Handling Skids, Semi-Skids, and Trucks

Materials-handling devices are all-steel, welded construction. Skids provide four-way entry for lift trucks, available in sizes from 24 x 30 in. to 48 x 72 in., with standard underclearances from 3½ to 12 in.

Semi-skids can be used with lift trucks or jacks, and are available with stake sockets for conversion to shelf units.

Floor trucks have longitudinal panels and outside stake sockets. Available in sizes from 24 x 36 in. to 42 x 72 in.

Market Forge Co, Materials Handling Div, 35 Garvey St, Everett 49, Mass

Wheel dresser extension used with standard J&S Form Master angle and radius dresser permits making larger radii. Concave range is increased from 7 to 15 in. on a 7-in. wheel; convex, from 4 to 12.

J&S Tool Co, 87 Dorsa Ave, Livingston, NJ

High-Speed clutch controls for presses equipped with pneumatic clutch and brake, adaptable for installation on old or new presses, are available in three enclosure sizes for inching, single stroke, and continuous operations.

Fawick Airflex Division, Fawick Corp, 9919 Clinton Rd, Cleveland 11, Ohio

Worksaver Truck Has Dynamic Braking

Yale & Towne Worksaver trucks can be equipped with dynamic braking, an extra braking force for positive speed control when truck is descending ramps under heavy loads. Braking is applied by pushing a button on Worksaver handle and then re-

RB&W FASTENER BRIEFS

RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY

Technical-ities

By John S. Davey

The Proper Loading of Bolts

The pre-load, or residual tension, in a tightened bolt means more to assembly strength than the actual strength of the bolt itself.

In a joint, a bolt torqued to its proper load level resists a maximum amount of external load without loosening. Designers can take advantage of this fact and assure better results, and at the same time, cut costs.

For example: One designer calculated that truck frames needed high strength bolts at least ½" in diameter. So he used ⅝". But on the assembly line, these were being torqued to 100 ft.-lbs. whereas they needed at least 200 ft.-lbs. for proper residual tension. The ½" bolt at 100 ft.-lbs. would actually have given the stronger assembly and at less cost.

In another case, the bucket on earth moving equipment was always coming loose. The design engineer kept increasing the size of the bolt up to 1¼", but to no avail. The impact wrench used was supplying far too little torque for this size. We suggested a return to the original ¾" bolt used, set up to 350 ft.-lbs. torque. It solved the problem.

In short, the more you stress a bolt within its elastic limit, the greater its ability to stay tight and make a strong assembly.

Symmetrical flow lines assure strong bolt heads

Photo of perfect cold worked blank after first upset.

Effect of improper forming is a poor head like this.

IN THE manufacture of bolts and cap screws, the first upset of metal is a vital one. It determines the flow lines in the bulb which will form the head. A symmetrical flow assures no laps and, therefore, no weak spots or cracks in the final upset of the head.

MACHINE OPERATOR'S SKILL VITAL

The upper photo shows a longitudinal section of a blank after the first upset and on its way to becoming an RB&W standard bolt. Note the even distribution of flow lines. This bulb will become a perfect head.

The lower photo shows what can happen with poor tools, inexperienced operators or without precision setup of the cold headers. Note how pronounced is the unbalanced flow pattern which resulted from a bulb with just a minute defect.

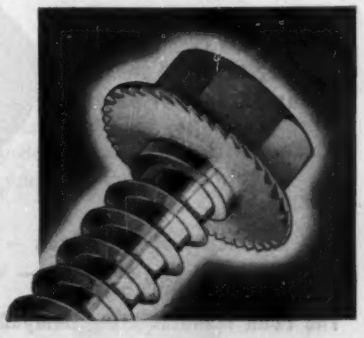
DEPENDABLE FASTENERS

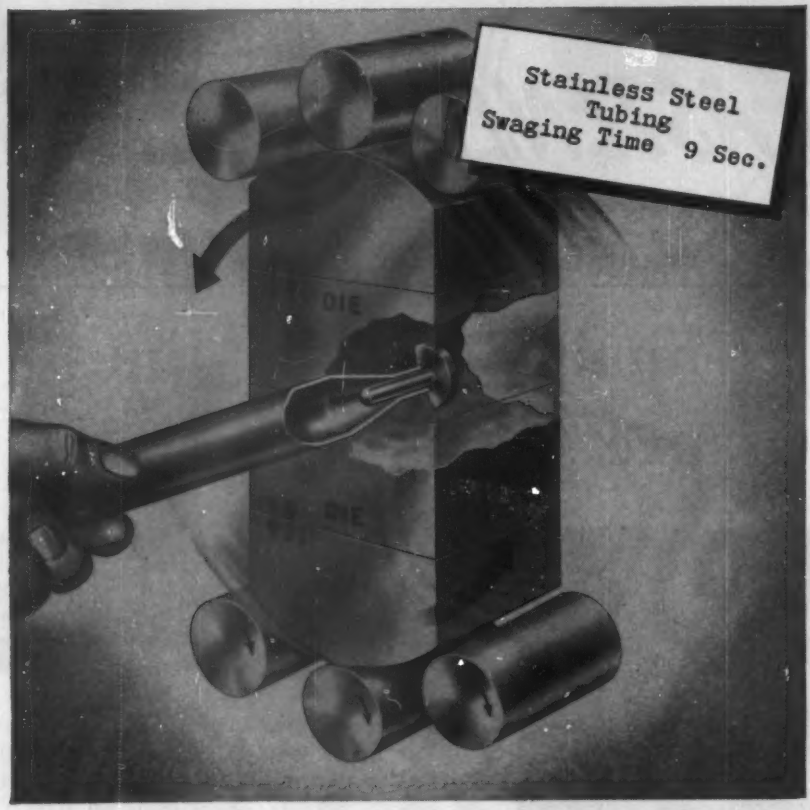
Cap screws and bolts also get a bright smooth finish from the right kind of cold forming. But above all, they offer the designer low cost fasteners with sound internal structure. Standard RB&W fasteners can be loaded to their proper level —become a strong point in any assembly.

For help on your fastener problem, contact Russell, Burdsall & Ward Bolt and Nut Company. Plants at: Port Chester, N. Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

The Only Screw That Stays Tight

The continual heating and cooling caused loosening of handle screws on the flat irons of one manufacturer. Every type tried failed to stay tight until RB&W's unique Spin-Lock tapping screws were used. This solved the problem. Their hardened teeth lock into the surface, require more torque to loosen than to tighten. One piece fasteners, they speed assembly time.

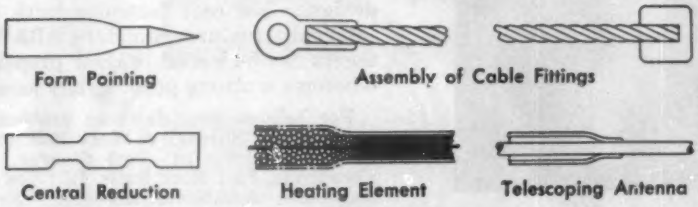




You save several machining and finishing operations with rotary swaging

You also save time, material and labor costs . . . greatly increase output . . . in a variety of pointing, tapering, reducing, sizing, forming and assembly operations.

SOME SWAGING EXAMPLES



Check with Fenn for engineering advice on swaging your product or parts.

FENN

Precision Rolling Mills — Turks Heads — Wire Shaping Mills
Swaging Machines — Wire and Tube Drawing Machines

The Fenn Manufacturing Company, 000 Fenn Road, Newington, Connecticut

versing direction control, making in effect a brake out of the motor.

Operation reverses circuits in the motor and the energy generated is absorbed by the resistance of the gravitational force of the machine and load. Because maximum braking force of feature cannot be applied immediately, there is no danger of sudden, jolting stop.

According to manufacturer, dynamic braking places no more load on the resistor in truck's electric motor than in normal operation.

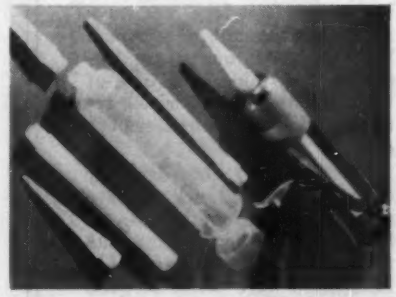
Yale & Towne Mfg Co, 11000 Roosevelt Blvd, Philadelphia 15, Pa

Cutting Torch Tip Cleaners

Set of spiral tip cleaners is made of stainless steel held to close tolerances. Double-spiral ridges provide for chip clearance which allows dirt and carbon particles to be removed from gas and oxygen orifices without damaging tip ports.

Standard set of 12 cleaners will clean 27 drill sizes ranging from sizes 49 to 75. Cleaner selection chart showing which cleaner to use is stamped on back of aluminum case furnished with set.

Universal Cutting and Welding Equipment Mfg Co, 2850 Ravenswood Rd, Fort Lauderdale, Fla



GUN FOR SEALING OPERATIONS uses disposable cartridges and nozzles molded of Tenite polyethylene. Cartridges containing caulking compound fit into gun barrel. Threaded nozzles, available in a variety of sizes and shapes, screw into front end of cartridges. Press on trigger turns on air pressure, causing sealant to extrude — *Eastman Chemical Products, Div Eastman Kodak Co, 260 Madison Ave, New York 16, NY*

Automatic Clutch Action Smoothes Lapping Operation

Mercury automatic clutch for smooth power input was designed for Norton single-face flat lappers. Clutch uses inertia-delay principle for full-load starting; electric motors used to

Tool Steel Topics

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corp. Export Distributor: Bethlehem Steel Export Corp.

Want Fast Tool Steel Service?

SEE YOUR BETHLEHEM DISTRIBUTOR

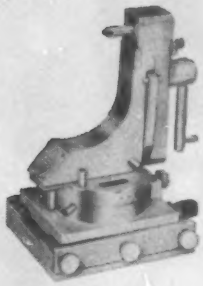
Whether you want to order a quantity of tool steel, or merely a short bar, or just would like a bit of advice about the correct method of heat-treatment, you're sure to find your Bethlehem tool steel distributor anxious to be of service.

Prompt service is your distributor's middle name. He makes it a point to know your city like a book—its background, its people, its industry. He knows what grades of steel you are most likely to need, and in what quantities. And so he keeps large stocks of Bethlehem tool steel on hand, in a virtually endless variety of types, all of them ready to go at a moment's notice.

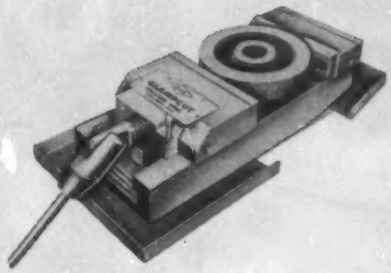
If you would like bars cut to special length, or if there's a tricky phase of metallurgy or some other tool-steel problem troubling you—again, your distributor is at your beck and call. He's a real friend. They don't come any better. It will pay you to get to know him.

BETHLEHEM STEEL

J&S DOWN-HOLDING DEVICES and WHEEL DRESSERS LEAD THE FIELD

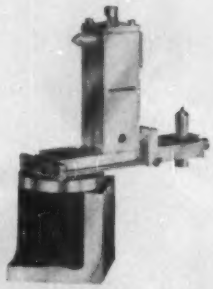


Fluidmotion Wheel Dressers—Dress two angles tangent to a radius, using ONE handle in one continuous motion. Operation is so fast and simple that beginners can use them. For all types cylindrical and surface grinders.



J & S Swivel Vise—The only hardened and ground swivel vise that mounts low, swivels, needs no pedestal. Patented down-holding clamping jaws give many times the holding power of an ordinary vise, yet only half the weight.

J & S All-Purpose Jaw Clamps — For any machine table or face plate. Five models—one adjusting screw has a holding force of 2½ tons on Small model, 12 tons on Jumbo model. Eliminate u-clamps, straps and fingers No obstruction problems, no interference with measuring tool readings.



J & S Form-Master—Sturdy wheel dresser for shops with less frequent wheel dresser requirements. High quality, 100% dust-proof, it is capable of dressing any radii up to 12" convex, up to 15" concave. Prices start at $45.00.

WRITE FOR INFORMATION ON THE NEW J&S PURCHASE PLAN

Write for free literature and further information.

J&S TOOL CO., INC. — JAW CLAMPS • PRECISION VISES • DOWN-HOLDING DEVICES — CLAMPCUT

J & S TOOL CO., INC.
870 DORSA AVE.
LIVINGSTON, NEW JERSEY

power lappers develop maximum torque during starting period, when torque requirement is greatest. During operation, over-size friction areas in clutch are designed to assure positive power without slipping. Clutch slips when excessive over-load is applied, preventing damage to motors and wiring.

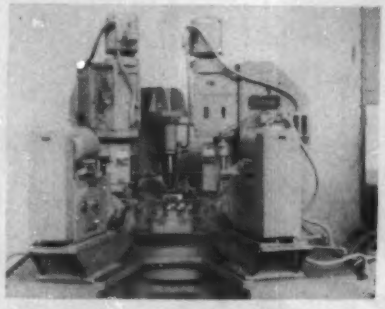
Mercury Clutch Div, Automatic Steel Products, Inc, 1201 Camden Ave SW, Canton 6, Ohio

Brazing Process

Superwelding, a high-temperature, high-production copper-brazing process, permanently bonds ferrous metal parts in a controlled, non-oxidizing atmosphere. It reportedly reduces assembly and prototype fabrication costs as much as 80%.

Safe operating temperatures range from –100 to 800 F for continuous service, or to 1800 F for short periods of time. Parts can be no larger than 10 x 24 x 36 in.; cross sections should not exceed 1½ x 1½ in.

Superweld Corp, 6840 Vineland Ave, N Hollywood, Calif



Avey Indexing Machine Drills, Mills, Broaches

Six-station automatic indexing machine for drilling, milling, and broaching is arranged with five standard Avey cam feed units, each driving multiple-spindle heads. Machining components are mounted at suitable angles around a 36-in. automatic index table.

Index table and all machine heads are interlocked electrically, and machine performs by remote control through a JIC electrical control panel.

Fan-type steel base contains hydraulic system as well as chip disposal and coolant system.

Avey Drilling Machine Co, Cincinnati 1, Ohio

Epoxy Adhesive

R & A Bondmaster M620 is one-part-paste, thixotropic, epoxy-based ad-

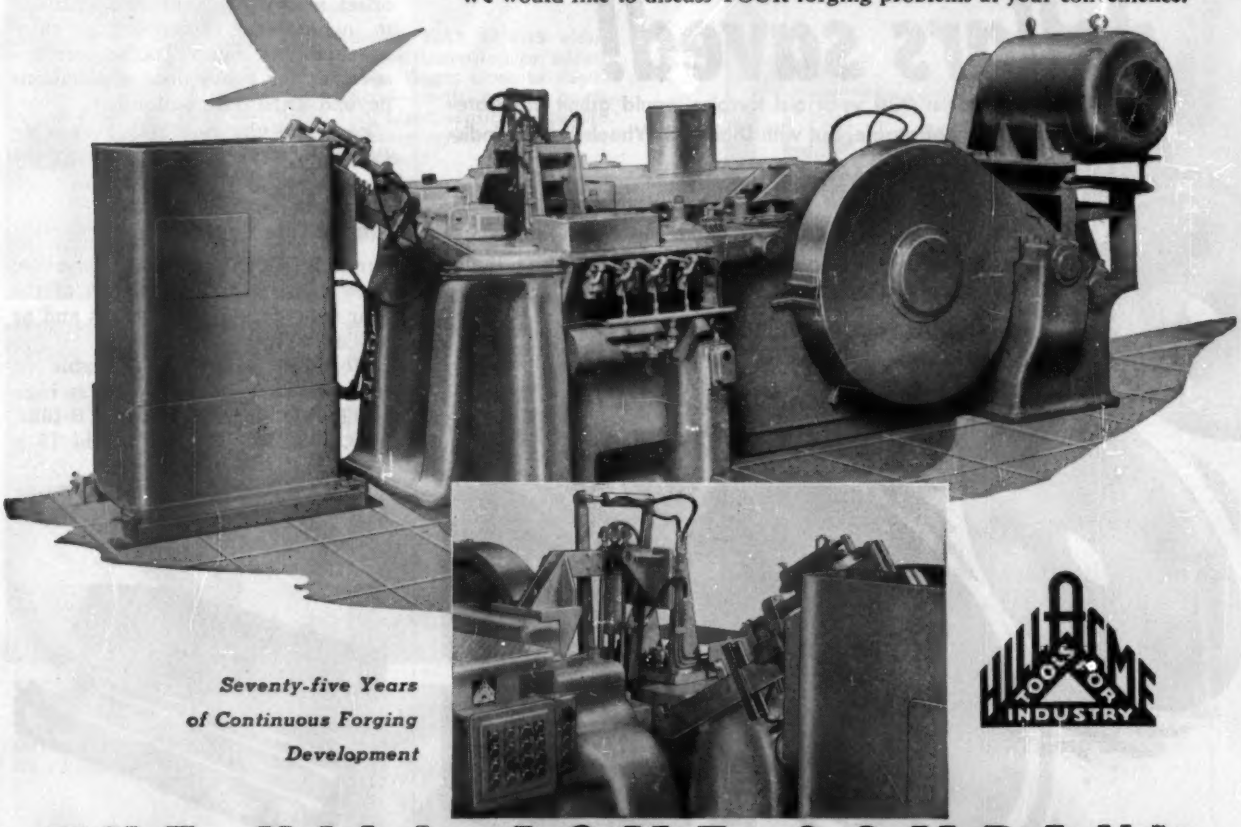
ACME MODEL XN

produces 2,400 completed forgings per hour!

A standard 3" ACME XN forging machine is producing, in multiple operations, a completed forging with every stroke of the machine in the plant of a large automotive manufacturer. Continuous operation with an automatic feeding device makes this amazing production possible.

PHENOMENAL SAVINGS

The increase in output through continuous operation of this ACME XN forging machine results in savings which are not only impressive but approach the incredible. The ACME XN with automatic feed is adaptable to either single or multiple operation forging. Every job, of necessity, calls for special design in the feed mechanism depending upon the shape, size and weight of the material involved. ACME XN forging machines are made in capacities from 1" to 5". We would like to discuss YOUR forging problems at your convenience.



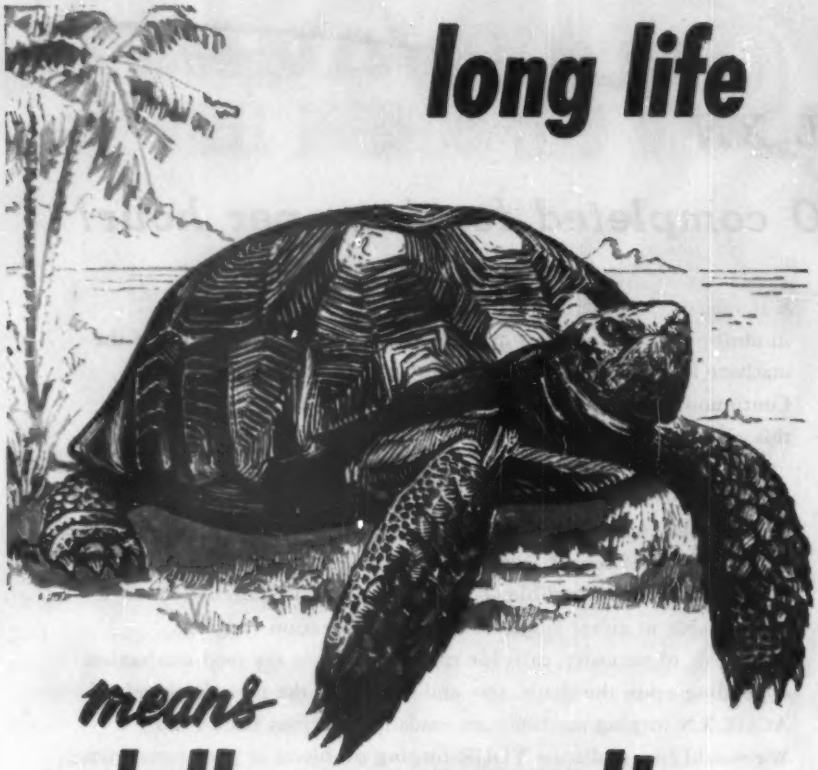
Seventy-five Years of Continuous Forging Development

HILL ACME TOOLS FOR INDUSTRY

THE HILL ACME COMPANY

ACME MACHINERY DIVISION • **1209 W. 65th St., Cleveland 2, Ohio**
ESTABLISHED 1882

"ACME" FORGING • THREADING • TAPPING MACHINES • ALSO MANUFACTURERS OF "HILL" GRINDING AND POLISHING MACHINES • HYDRAULIC SURFACE GRINDERS • "CANTON" ALLIGATOR SHEARS • BILLET SHEARS • PORTABLE FLOOR CRANES • "CLEVELAND" KNIVES • SHEAR BLADES



long life

means

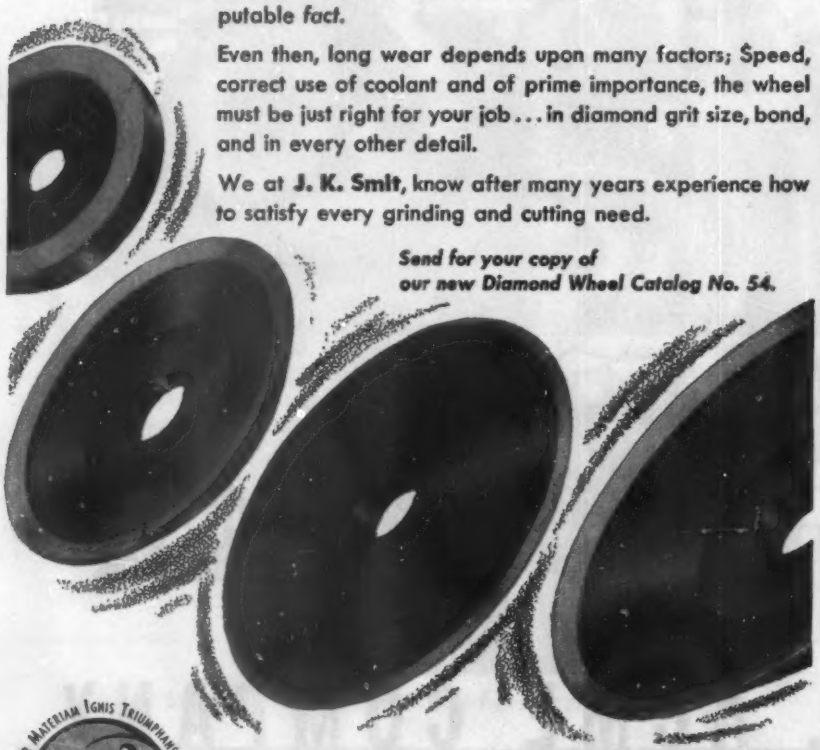
dollars saved!

Whether a 200 year old tortoise would admit this statement is debatable, but with Diamond Wheels it is an indisputable *fact.*

Even then, long wear depends upon many factors; Speed, correct use of coolant and of prime importance, the wheel must be just right for your job . . . in diamond grit size, bond, and in every other detail.

We at **J. K. Smit,** know after many years experience how to satisfy every grinding and cutting need.

Send for your copy of our new Diamond Wheel Catalog No. 54.



SUPER MATERIAM IGNIS TRIUMPHANS

J. K. SMIT & SONS, INC.

HOME OFFICE AND PLANT

MURRAY HILL NEW JERSEY

Additional plants in London, Paris, Amsterdam and Toronto, Canada

hesive for bonding metals to metals or to rigid plastics. Product may be used directly from the shipping container, eliminates mixing of a separate resin and hardener.

Curing cycles range from 7 minutes at 535°F down to 1½ hours at 350°F. Lower curing temperatures, down to 260°F, may be used where a longer curing time cycle can be tolerated in production.

Thixotropic additive in adhesive eliminates drip or "run" before or during cure. Substance has a buttery consistency and can be spread with brush or spatula without danger of flow, it is reported.

Rubber & Asbestos Corp, 225 Belleville Ave, Bloomfield, NJ

Firthite Toolholders Have Throwaway Inserts

Firthite line of Thriftool toolholders uses throwaway carbide inserts with six cutting edges. Tool is offered in shank sizes as small as ½ in.

Line termed Mechanidex is similar to Thriftool, but is designed with offset at top of shank and chamfer to include area of support for chipbreaker and clamp. Toolholders are specified for heavy-duty applications beyond Thriftool's suitability.

Firth Sterling Inc, 3113 Forbes St, Pittsburgh 30, Pa

Plastic Tote Boxes

Series LTB, made of rubber styrene, have molded-in-ribs on each of the four sides to act as stiffeners and as holders for dividing panels.

Nestable units are available in four standard sizes: 8 x 8 x 6 in. high (LTB-101), 15 x 12 x 10 (LTB-102), 24 x 15 x 12 (LTB-103), and 15 x 14 x 5¾ (LTB-104).

Luria-Cournand, Inc, Havre de Grace, Md

Sound Detector Locates Defects In Motors, Machines, Pumps

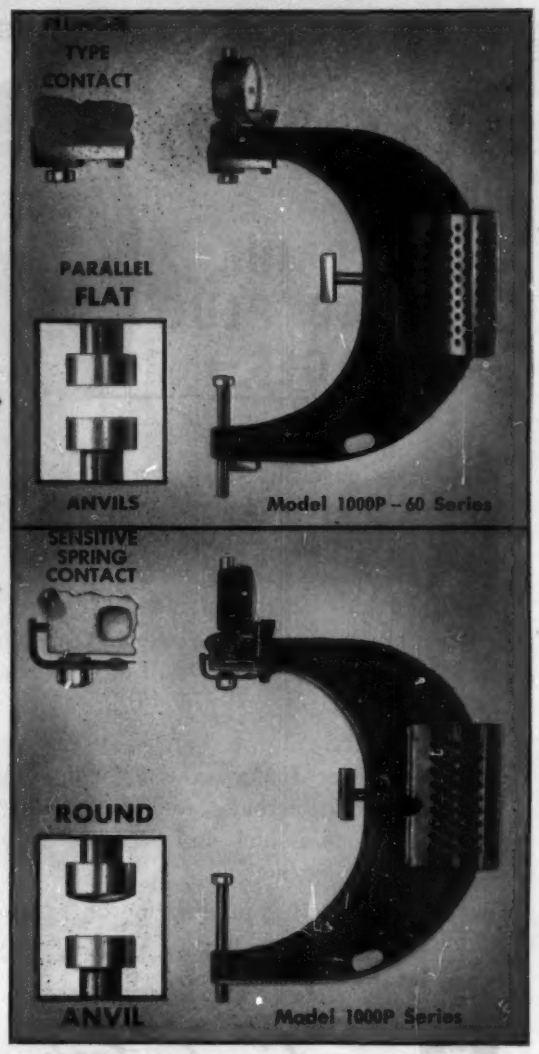
"Trouble Detector" locates defects in motors, turbines, pumps, automotive

You can have your SNAP GAGE as you want it –

ALL CONTACTS –
Either TUNGSTEN CARBIDE for enduring accuracy or STEEL for price.

FLAT, PLUNGER ANVILS where anvils must gage close into corners of shoulders and yet remain perfectly parallel at all times. Gage is adjustable yet maintains accuracy, graduated in tenths.

ROUND, SPRING ANVILS for more general requirements. Sensitive contact: spherical. Lower: flat and adjustable. Inexpensive, fast and accurate, graduated in tenths.



SMALL FLAT ANVILS either single dimension or adjustable. Gages close to shoulders – anvils remain parallel. Light, sensitive, positive. Nearest style to "fixed" snap gages.

RETRACTING ANVIL for super finishes and soft material. Sensitive, flat lapped anvils remain parallel throughout adjustment.

RUGGED PLUNGER TYPE for heavy duty. Upper anvil has spring tension sufficient to counteract weight of gage and operator's hand.

RUGGED SPRING TYPE lower anvil is sensitive so that weight of gage and operator's hand rests on the fixed contact.

We make Indicating Snap Gages to suit any whim or necessity

These Gages are made to meet all the usual physical and accuracy needs of gage users. They can be had in a wide range of sizes and can be modified to suit particular needs. If you haven't seen just what you *must* have, ask us about what you want. We also make Air Snap Gages.

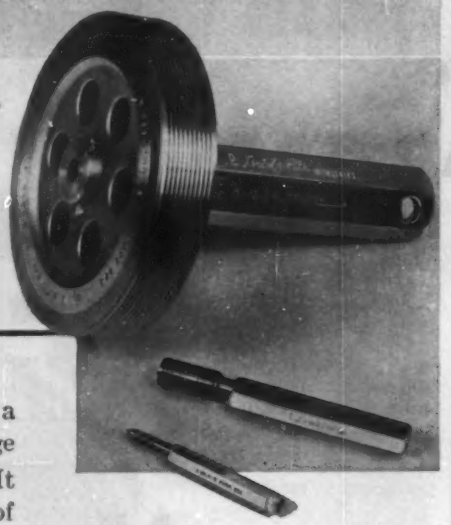
FEDERAL PRODUCTS CORPORATION
Dept. 2F • Providence 1, Rhode Island

Ask **FEDERAL**
FOR MODERN GAGES AND GAGING TECHNIQUES

True Economy in Thread Gaging Calls For

Lincoln Park

CARBIDE THREAD PLUG GAGES



The largest gage illustrated is a carbide buttress thread plug gage of 5½" diameter—12 pitch. It serves as a good example of Lincoln Park's ability to meet special thread gaging requirements. Or, when customers' needs are for standard carbide thread gages, Lincoln Park offers a complete range of types and sizes.

The manufacture of thread plug gages has been a Lincoln Park specialty for many years. In fact, this company was the first to successfully utilize cemented-carbides for such products. It is this unequalled experience that assures you of gages of unquestioned accuracy and maximum service life.

Let us send you full information on Lincoln Park thread plug gages produced in carbide—or in steel.

THE PLUS IN PRECISION

Lincoln Park INDUSTRIES, INC.

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GET THE PLUS IN PRECISION IN All LINCOLN PARK PRODUCTS

PLUG AND RING GAGES—Carbide, Carbide Plated, Chrome Plated, Steel • DIAL SNAP GAGES • THREAD GAGES—Carbide, Steel • SETTING DISCS • SETTING PLUG GAGES • CARBIDE SERRATED ANVILS • CARBURS—Carbide Rotary Files • SPECIAL GAGES • SPECIAL NON-CUTTING PRECISION TOOLS • PRECISION PRODUCTION PARTS.

Complete literature supplied upon request.

LINCOLN PARK INDUSTRIES, INC.

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products, and all types of machines by means of sound.

Device consists of a bent membrane and tripartite, screwed sound conductor with electric shock-protecting and sound-absorbing bar. Sound conductor is placed against area of suspected trouble, and membrane placed against the ear. Defects can be located and isolated by amplified sounds of knocking, squeaking, or scratching. Complete unit is priced at $41.50.

American Zerlon Corp, 35 W 33rd St, New York 1, NY

Epoxy paste laminating resin, Epocast 2C, reportedly has ability to cling to vertical walls and ceilings without sagging or dripping. In application, hardener is mixed with paste laminating resin and mixture is brushed on surfaces to be protected. Substance can be applied to preparation of corrosion-resistant surfaces, lamination of fiberglass jigs and fixtures, and surfacing of wood, metal, and concrete storage tanks.

Furane Plastics, 4516 Brazil St, Los Angeles 39, Calif

Subland drills, for use in performing two or more operations in one tool pass, are combination drills with separate margins for each of the two or more diameters extending full length of flutes. These special tools are specified on order.

Chicago-Latrobe, 411 W Ontario St. Chicago 10, Ill

Adjustable Bar Clamp

Style 37 is addition to Jorgensen line of steel bar clamps. Lightweight clamp has multiple-disc clutch for easy release after clamping; finger pressure on clutch, either above or below clamp bar, releases sliding head for instant adjustment.

Capacities range from 6 to 24 in. All sizes "reach" 2½ in. from the bar.

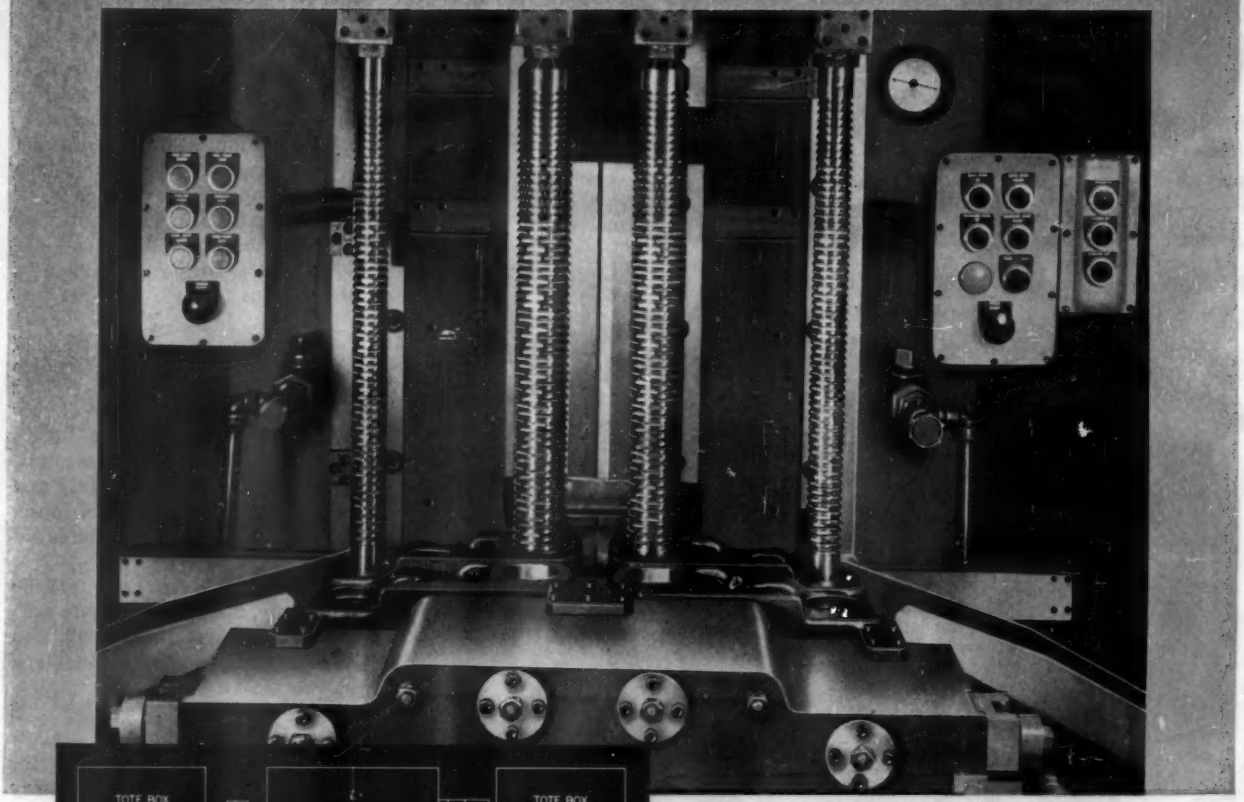
Adjustable Clamp Co, 417 N Ashland Ave, Chicago 22, Ill

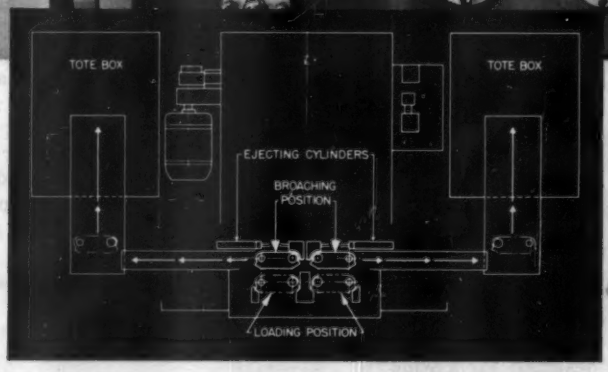
Vapor Phase Inhibitor Is Heat-Sealable

Orchard heat-sealable VPI is a volatile rust inhibitor designed for use with heat-sealing packaging machinery. Material is supplied in Kraft sheet coated with two grams of VPI per sq ft. Standard rolls available are 36 in. wide and 200 yd long, weigh 48 lb.

Following heat-sealing procedures

DETROIT BROACH PULL DOWN MACHINE BROACHES FOUR HOLES IN SIDE BARS





***PARTS BROACHED AND UNLOADED AUTOMATICALLY!**

***HOLE LOCATION HELD WITHIN .002"**

The Cycle—This set-up to broach two holes in each of two side bars per pass is mounted on a standard Detroit Broach 25-ton Vertical Pull-Down machine with a 54" stroke. The operator simply loads two parts per cycle and pushes the start buttons... the balance of the operation, including unloading, is completely automatic.

When the start buttons are pushed, the parts are carried by a tray into broaching position and the broaches are automatically lowered and engaged into pullers. The tray returns to loading position as the machine is broaching. When the machine reaches the bottom of the down stroke, ejectors are energized which push the parts into unloading troughs and the parts slide down into tote boxes.

The parts are alloy steel forgings, core drilled prior to broaching. The broaching operation finishes the holes and corrects hole location within .002" total tolerance. This accuracy is made possible by exclusive Detroit Broach Pull-Down design in which the tool handling slide gives rigid support to the broaches and follows them throughout their entire cutting stroke.

The operation described at the right is typical of the production economies and efficiency which are characteristic of Detroit Broach engineering. Such efficiency provides automatic parts handling in conjunction with automatic machine operation and thus reduces labor costs and error.

Whether your operation calls for a single unit-type operation or a broaching operation that is tied directly into automated production, you can rely on Detroit Broach engineering to provide the machine and tooling that will do the job dependably.

Detroit Broach COMPANY

OFFICES IN PRINCIPAL CITIES THROUGHOUT THE WORLD — ROCHESTER, MICHIGAN

A TRANSPARENT ALL-CHEMICAL SOLUTION FOR GRINDING

Lusol K-7 is a new all-chemical liquid concentrate designed for a wide variety of grinding operations. It is recommended for use on all steels and is particularly suited for cast and malleable irons, titanium, carbon, rubber, ceramics and plastics. Instantaneously soluable in any water, hard or soft, it forms a clear, transparent, colorless solution that resists contamination, settles chips super-fast, and remains clear after repeated use. It is non-foaming and runs absolutely flat under all conditions. It provides maximum rust protection for all ferrous metals, including cast and malleable irons. It maintains clean wheels at all times. They just don't load up when you use Lusol K-7. For better grinding every time, use Lusol K-7. Write for complete information.

THE Lusol LINE

. . . BETTER PRODUCTS FOR BETTER METAL WORKING

F. E. ANDERSON OIL CO., INC.

PORTLAND, CONNECTICUT

5A055

are recommended by company: bar-type heat sealers—500°F, 2 sec dwell time, and 60 lb pressure; automatic heat-sealing equipment—600°F, ½ sec dwell time, and 15 lb pressure.

Orchard Paper Co, 3914-24 Union Blvd, St Louis 15, Mo

Aluminum finisher, a cold chemical coating Alumblack, is said to give soft or high-gloss finish immediately upon application, requiring drying time of 1 minute. Because surface tension is reportedly very low, it can be dipped, sprayed, or applied with rag or brush.

Birchwood Chemical Co, 4500 W 44th St, Minneapolis, Minn

Heavy-Duty Soldering Gun

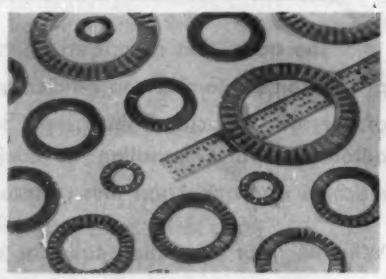
Wen Model 288 soldering gun is 200-watt tool reported to come up to working heat in less than 5 seconds. Features include silver-plated tip and connectors, heavy-gage steel nose, built-in spotlight, and shatter-proof plastic housing.

Specifications: 110/120v, 50/60 cycle ac only, 2 amps maximum current. 2¼-lb gun retails at $9.95.

Wen Products, Inc, 5808 Northwest Hwy, Chicago 31, Ill.

Metallic coating which is 95% zinc is applicable with brush or spray gun to standing structural parts. Coating is useful for renewing galvanizing on parts that have lost the original protective coating or for applying zinc protection to standing parts which, being already in position, could not otherwise be zinc coated.

Wilbur & Williams Co, 130 Lincoln St, Boston 35, Mass.

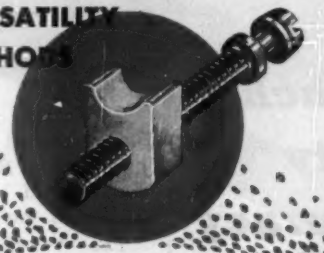


Needle Thrust Bearings For Compact Applications

Torrington Series NTA needle thrust bearings, only 0.078 in. thick, are designed for minimum space requirements in thrust applications. Needle

Bodine CASE HISTORY NO. 42

HEADLIGHT ADJUSTING SCREW ASSEMBLY SPOTLIGHTS VERSATILITY OF BODINE METHODS



This is but one of many ways in which versatile, time-tested Bodine basic machines and units can be teamed to create high-speed, cost-cutting assembly units without resort to costly "specials."

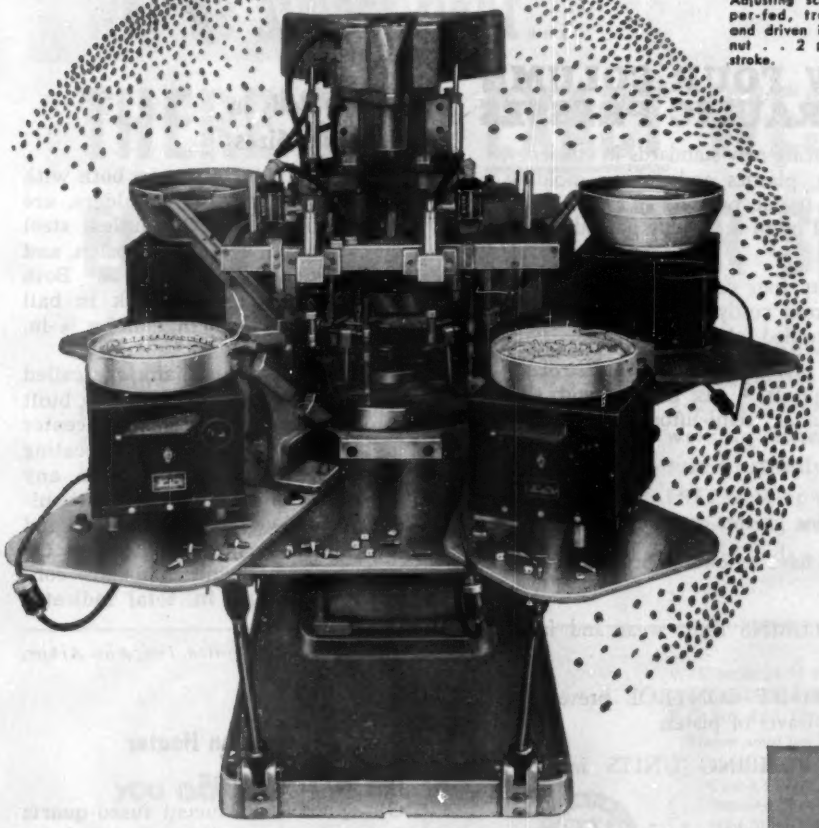
Note especially the ease and convenience with which auxiliary equipment (in this case automatic hopper feeds) can be grouped around the Bodine "chassis." Note also the high production and close limits maintained on this day-in, day-out production line job for one of the world's largest automobile manufacturers.

PRODUCTION: 3,000 completed assemblies per 50-minute hour. Machine speed, 30 strokes per minute.

1 Unthreaded molded nylon nut hopper-fed and transferred to the dial fixture . . . 2 pieces per stroke.

2

Adjusting screws hopper-fed, transferred and driven into nylon nut . . 2 pieces per stroke.



3 Auto eject completed assembly. Depth of screw driving held consistently within ½ turn in untapped nut.

Write Dept. AM-12

If high-speed, low-cost assembly is one of your problems . . . in metals, plastics, or a combination of both . . . with or without concurrent machine operations . . . check first with Bodine. The possibilities of our methods are practically unlimited.

THE Bodine CORPORATION
BRIDGEPORT 5, CONNECTICUT
AUTOMATIC DIAL TYPE DRILLING, MILLING, TAPPING, AND SCREW INSERTING MACHINES

88055

OUTSTANDING!

Never Before Such Versatility and Accuracy Available in its Price Range!

K. R. WILSON'S NEW FOUR COLUMN DOWN-ACTING HYDRAULIC PRESSES

Here's the Guided Platen Press that's setting new standards in efficiency, low cost metal forming and drawing, plastics and rubber molding, laminating, die cutting, assembling, die tryout, pressing and many other applications that require precise control of an accurately guided platen. Here are the details:

A standard line of 25-200 tons capacity four column presses built to accuracy heretofore obtainable only from costly custom-built presses. Platens are align-bored to optically controlled tolerances.

Operational Features: variable pressure • adjustable stroke • adjustable daylight • wide range of speeds • fast traverse with slow pressing • variable speed • manual, semi-automatic and full automatic controls.

Design Features:

- PLATENS ARE ALIGN-BORED for greater accuracy.
- EXTRA-LONG PLATEN GUIDES have renewable bronze bushings and lubricating fittings.
- POLISHED AND GROUND COLUMNS resist wear and increase accuracy of platen travel.
- MAXIMUM STROKE SAFETY LIMIT CONTROL prevents damage to dies or press due to over-travel of platen.
- COMPACT, SELF-CONTAINED PUMPING UNITS insure dependable, trouble-free service.
- CUSTOM ACCURACY, custom quality at standard line prices.

Get full details and complete specifications. Write for Bulletin No. 95.

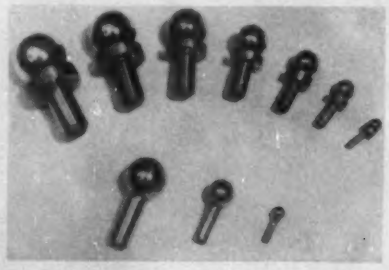
HYDRAULICS DIVISION
K·R·WILSON·Inc.
ARCADE, NEW YORK, U. S. A.

bearings may be used alone for thrust loads or in combination with company's Type DC needle roller bearings for combined loads.

Four sizes are available: ½-in. bore by 15/16-in. outer diameter; ¾-in. by 1¼-in.; 1-in. by 1 9/16-in.; and 1¼-in. by 1 15/16-in. Bearing bores are designed for a running fit on standard shafts. Bearing rollers are completely retained in a two-piece cage.

Units are made of high-carbon chrome steel hardened to R_c 60 minimum. Rollers are precision ground and lapped to tolerance of 0.0002 in. on the diameter.

The Torrington Co, Torrington, Conn



Tooling Balls in Variety of Sizes

Tooling balls have shanks both with and without locating shoulders, are made of Type 440-C stainless steel for protection against corrosion, and are hardened to R_c 55-58. Both types are carried in stock in ball sizes from ¼ through 1 in. by ⅛-in. increments.

Balls with plain shank are called fixture balls and are generally built into jigs and fixtures where center of ball provides a positive locating point for positioning work in any plane. Balls with reference shoulder are known as checking balls and are used for inspection purpose. On both types ball and shank are concentric to 0.0002 in. total indicator reading.

Industrial Tectonics, Inc, Ann Arbor, Mich

Quartz Immersion Heater Has U-Type Design

Glo-Quartz translucent fused-quartz immersion heater was designed for use in the heating of acid electroplating and pickling solutions. Manufacturer guarantees that the U-tube element will not burn out within a period of one year and states that it should last several years under normal usage.

Heater consists of two interchange-

Why be almost right...

THERE'S AN EXACT WESTINGHOUSE ELECTRODE FOR YOUR SPECIFIC JOB

For better welding performance let Westinghouse welding engineers help you select the *right* rod for your particular application. Whether it's mild steel, low alloy steel, stainless steel, cast iron or hard surfacing, the broad range of Westinghouse types and sizes assures you of an electrode best for you—best for top welding results at lower cost in your particular application.

FREE samples on request—Try a quality Westinghouse electrode on your toughest job. Ask for a free sample from your Westinghouse welding distributor, or use coupon below. Be sure to specify type of job involved.

FREE welding guides—These helpful manuals can save you welding dollars. Send for your copies, today.

J-21837

YOU CAN BE SURE...IF IT'S

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WESTINGHOUSE ELECTRIC CORPORATION
Welding Department
P. O. Box 868, Pittsburgh 30, Pa.

Please send me literature on the items checked below

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- ☐ Cast-Iron Electrodes (B-6076)
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- ☐ Mild Steel Electrodes (B-6078)
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- ☐ New TA Welder (B-6367)
- ☐ Free Electrode Samples for (type of job)_____

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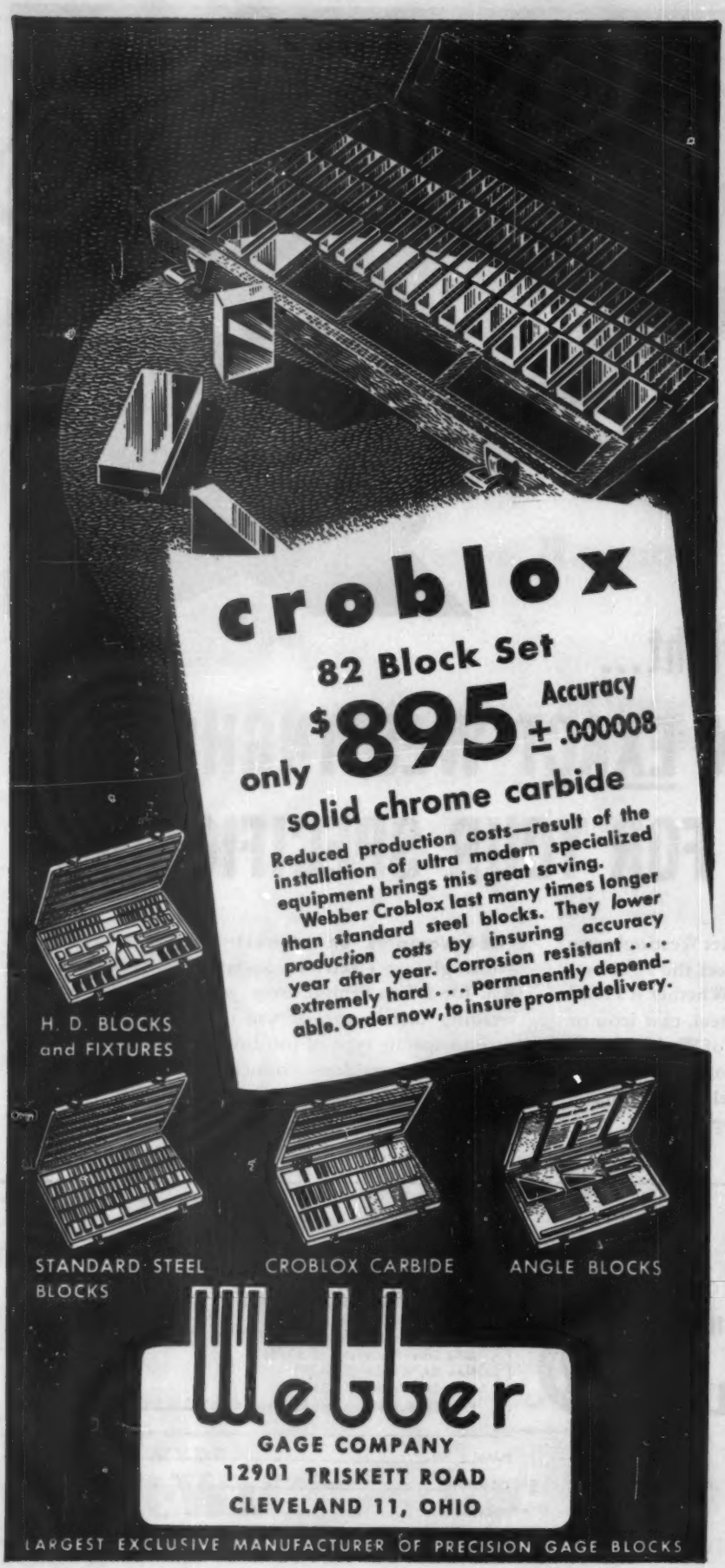
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only $895
Accuracy ± .000008
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Reduced production costs—result of the installation of ultra modern specialized equipment brings this great saving.
Webber Croblox last many times longer than standard steel blocks. They lower production costs by insuring accuracy year after year. Corrosion resistant . . . extremely hard . . . permanently dependable. Order now, to insure prompt delivery.
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12901 TRISKETT ROAD
CLEVELAND 11, OHIO
LARGEST EXCLUSIVE MANUFACTURER OF PRECISION GAGE BLOCKS

able components: U-shaped quartz heating element and combined junction box and guard assembly. Resistance heating element is mounted inside the U-tube and the coil is firmly supported with a special heat-conducting powder. Hermetic sealing locks out acid fumes.

U-tube element rests at the top on a neoprene gasket which absorbs mechanical shock on the guard. Heaters are made in standard voltages and wattages.

Glo-Quartz Electric Heater Co, Willoughby, Ohio

Diamond Impregnated Hand Hone Does Roughing and Finishing

Lite Hone incorporates two separate bonds in one tool. On one end of the No. 0042, Al-Aloid bond does roughing job; on other end is resin bond for finishing.

Transparent plastic handle indicates diamond-particle size for selection: clear for roughing; red for medium finishing; and blue for fine finishing.

AIT Diamond Tool Co, 8221 N Kimball Ave, Skokie, Ill

Cincinnati Grinding Compound Is Soluble, Transparent

Cimplus is new grinding compound which can also be used for machining cast iron. Water-soluble, transparent concentrate is said to provide rust control at dilutions between 1:100 and 1:200.

As water conditioner, compound can be used with company's Cimcool concentrate on operations where materials have high sulphur content or where water is hard.

Cincinnati Milling Products Div, The Cincinnati Milling Machine Co, Cincinnati 9, Ohio

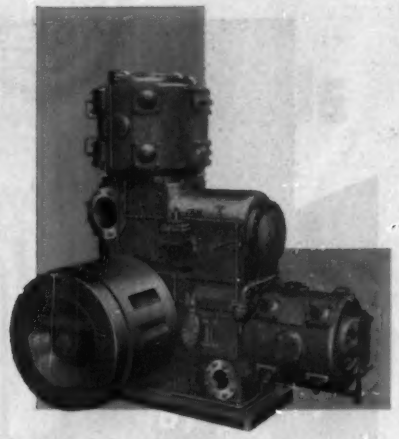
Automatic Bolt Trimmer

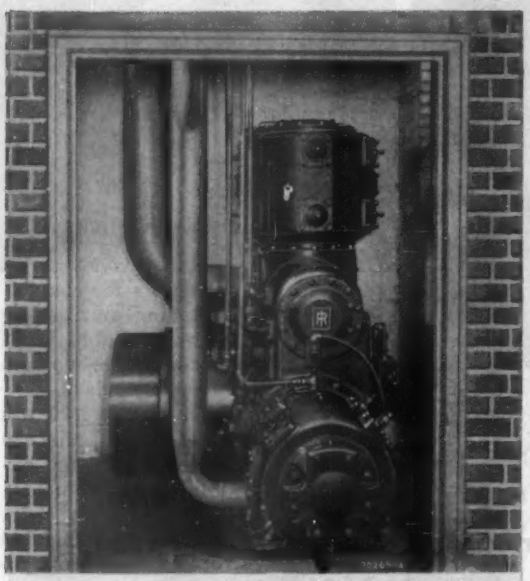
Haller horizontal crank press automatically, trims, reduces and rounds off ends of bolts, machine screws, and other fasteners in a single operation, in addition to pressing heads of socket screws. Carriage runs in long, adjustable nitrided steel plate and carries the matrix holder, which is adjustable by means of steel wedges.

Rugged construction employed in design permits final pressing of bolts with special head shapes that have been rough-pressed on double-blow cold upsetting machines (as in the final pressing of socket-screw heads). Reduction of bolts, normally required for subsequent thread roll-

MORE AIR POWER in less floor space

That's one of the many advantages offered by this space-saving **XLE** *compressor:*





A bronze company squeezed this XLE into a small, unused storage room.

Packaged design for minimum floor space, and specially balanced for minimum foundation... ideal for skid-mounting.

Easy to operate... push button starting, grouped controls, automatic force-feed lubrication, automatic condensate removal, automatic air-operated starting unloaders and capacity control.

Easy to install or relocate... ready-to-run, assembled shipment ... simplified air and water piping.

Easy to maintain... simplified long-life construction... full-floating, cool-running, aluminum-alloy bearings that require no adjustment... no need to open the sealed crankcase which stays clean inside... streamlined exterior also easy to keep clean.

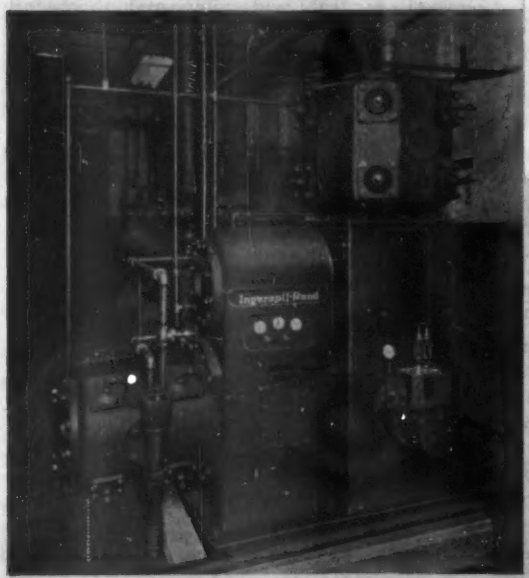
Low operating costs... new high-efficiency, long-life I-R Type A Channel Valves result in compressor efficiency comparable to the largest units... durable, high-efficiency tube-and-fin intercooler saves water... efficient direct-connected motor.

Built for reliable, continuous full-load service... sizes 125, 150, 200, 250, 300, 350 horsepower... discharge pressures 80 to 125-psi, two stage... write for more information today.

Ingersoll-Rand

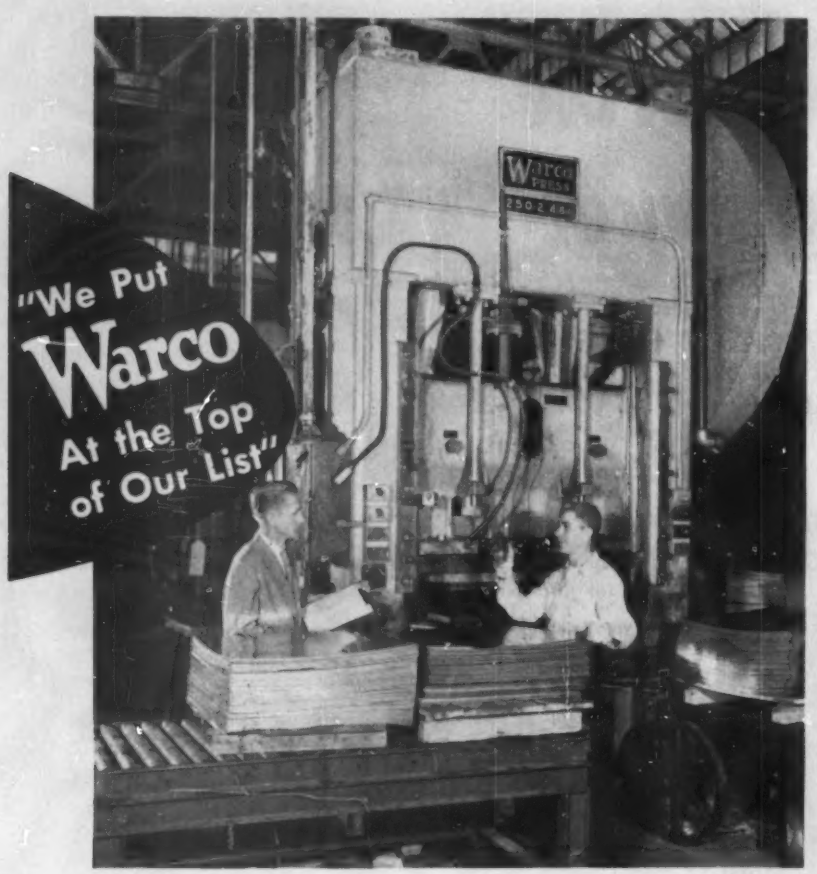
1-165 **11 Broadway, New York 4, N. Y.**

COMPRESSORS • AIR TOOLS • ROCK DRILLS
TURBO BLOWERS • CONDENSERS • CENTRIFUGAL PUMPS
DIESEL AND GAS ENGINES



A safety-razor manufacturer found plenty of space for this XLE installation in a screened-off basement corner.

And here's a compact, space-saving installation of an XLE compressor, aftercooler and air receiver in a tool plant



Nesco Plant Manager Gives Efficiency, Economy and Ease of Operation as Reasons for Selecting Warco Presses

"I would say that our experience with Warco equipment has been very satisfactory. We have many of these presses in our factory and are well satisfied with their operation. I feel that from the standpoint of efficiency, economy and ease of operation that Warco equipment is right at the top of our list." This from Martin M. Fisher, Plant Manager of the Nesco Division of New York Shipbuilding Corp., one of the nation's foremost producers of quality housewares.

Mr. Fisher's comments are echoed wherever Warco presses are in operation, for when users compare, they invariably find Warco performance to be superior.

If you are not already operating Warco equipment, why not let us put you in touch with someone who is? We know once you've talked with a Warco user, you'll be certain to add our name to your press supplier list.

Federal WELDERS

Warco PRESSES

The Federal Machine and Welder Company

WARREN, OHIO

ing, can be carried out simultaneously with the trimming process, or it can be handled as a separate operation.

Model AAG-III reduces bolts up to 0.118-in. diameter under the head; with Model AAG-00, bolt reduction is possible up to 0.787-in. diameter under head.

Haller, Inc, 684 Ann Arbor Rd, Plymouth, Mich

Engraver Bench

Heavy-duty steel bench is designed to accommodate company's Model D2 engraver. Cabinets and drawers are provided for storage of such accessories as master type sets and tools.

Bench weighs approximately 205 lb, is 28 in. long and 16½ in. wide.

Green Instrument Co, 335 Putnam Ave, Cambridge, Mass

Pneumatic Regulators for Loading, Gaging Applications

Governaire is designation for series of pneumatic regulators for controlling pneumatic loading and gaging applications. Eight available types include pressure regulators, volume boosters, and reversing relays.

Typical regulator, Series 4000, has five ranges (10, 30, 60, 150, and 250 psi); ⅝-in.-diameter supply and exhaust seats; three sizes (⅜ in., ½ in., and ¾ in. NPT with two ¼-in. gage taps). Series is recommended by manufacturer for such applications as welding head pressure control, punch press brake and clutch control, and cable and sheet tensioning devices.

Governaire Div, Bellofram Corp, Burlington, Mass

Pocket scriber, Scriber-Matic, has a retractable, replaceable point. Pocket-size unit operates like a ball-point pen, is priced at $1.

Lufkin Rule Co, Saginaw, Mich

Feedall Elevating Conveyor

Series 4500 is designed to transfer parts from one operating machine to another. It accepts parts from discharge chute of the first machine, elevates and synchronizes them for delivery to the next.

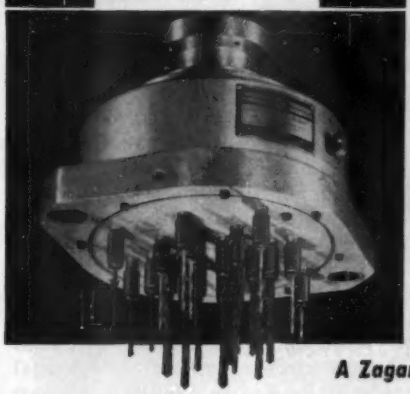
Unit will handle cylindrical parts up to 3½-in. dia, 1½-in. thick. Power is furnished by a ¼-hp 220/440-v motor through a variable speed drive.

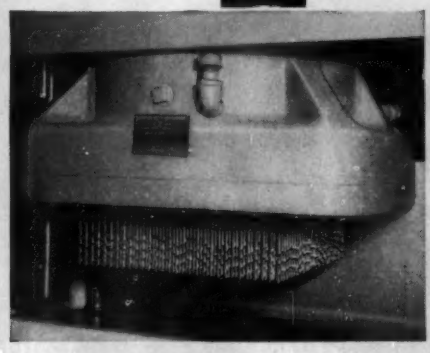
Feedall, Inc, Willoughby, Ohio

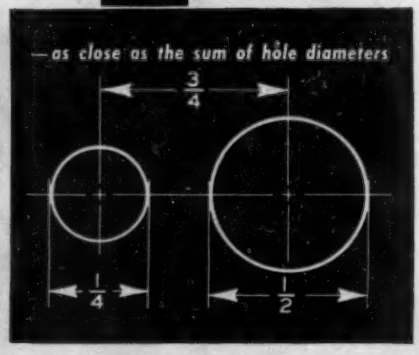
Zagar Gearless Drill Heads

put 4 big advantages to work for you

Any number of holes — **Any hole pattern** — **Any material** — **On all centers**





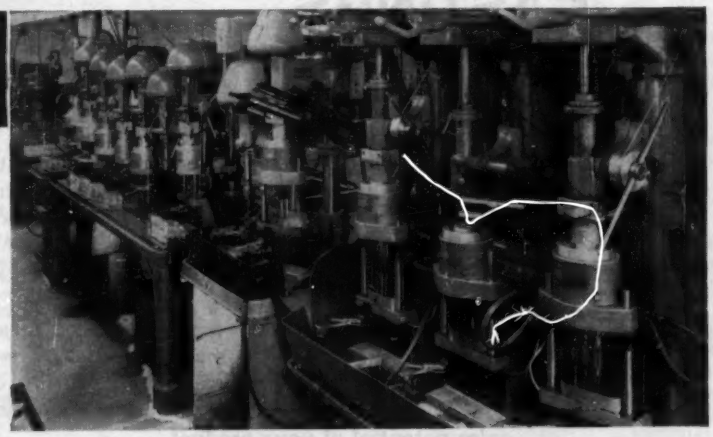


A Zagar drill head is never obsolete. Zagar can re-locate spindles for other hole patterns.

Can you visualize the savings made possible by drilling up to 1000 holes at one pass? Zagar standard practice can handle any machinable material up to 1½" diameter. Holes of varying diameters can be drilled to form any pattern. Zagar Gearless Drill Heads, their efficiency proven by many years' success, can be installed on existing drill presses. Or, Zagar will lay out the necessary tooling for your entire job. May we see your sample parts and study your requirements? There is only one *right* answer—one *best* answer—for those requirements. May we supply it?

Let **ZAGAR** tooling plan the complete job for you

Whether your runs are long or short, let Zagar engineering survey your needs with a view to saving you the cost of special machines. In the case at the right two lines of *standardized* self-clamping drill jigs ream, tap and drill an aluminum die casting, both valve body and cover. The problem of limited production was readily solved. What, sir, are your requirements?

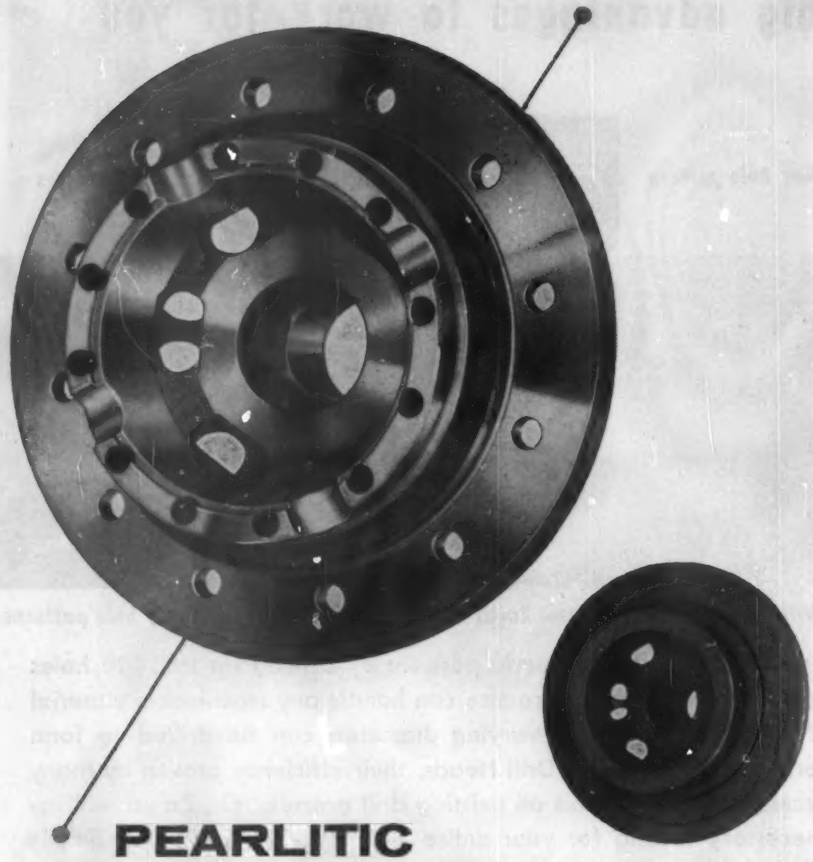


ZAGAR TOOL, INC. 24000 LAKELAND BOULEVARD, CLEVELAND 23, OHIO

Zagar TOOLS FOR INDUSTRY and SPECIAL MACHINERY

Get more information via Zagar's Engineering Manual "A-12."

MACHINABILITY INDEX 80-90*



PEARLITIC MALLEABLE CASTINGS

*B1112 STEEL = 100

Low machinability index of 80-90 (B1112 steel = 100) is probably reason enough to warrant serious consideration for your product.

But pearlitic malleable castings—from National—don't stop there. They have great ultimate strength . . . resist wear under heavy loads at high speeds . . . make excellent non-seizing bearings . . . can be air or liquid-quenched . . . can be smooth-finished.

Don't overlook the advantages of pearlitic malleable. For pearlitic malleable castings—from National—can often reduce manufacturing costs, weight and assembly time . . . can increase the sales potential of your product. AA-1806

NATIONAL MALLEABLE AND STEEL CASTINGS COMPANY

Cleveland 6, Ohio

The Nation's largest independent producer of malleable and pearlitic malleable

ROUND TABLE *Discussion*

GRIND OR GALLOP?

Will making an apprenticeship course more attractive in terms of pay and promises draw more candidates? Or will keeping the course tough weed out the half-hearted and unsuited?

MAKING it too attractive for young men to start in on an apprenticeship training course will more than likely draw many undesirables. I would much rather see the desire to learn come from the young man than to see any campaign instituted by the employer. When this happens you can depend upon it that the applicant has the right stuff in him to pay attention to his work and to go his way as an individual unlikely to be deterred from his avowed purpose to do all he can to further his own progress.

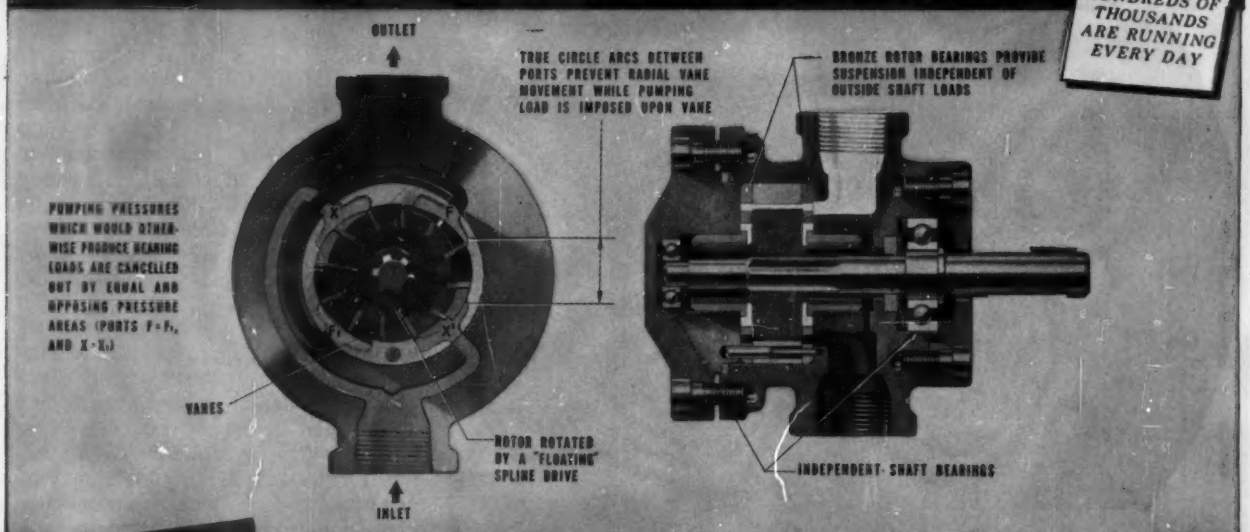
If the employer makes it as soft as he can in order to hold his potential mechanics he can expect to get soft product in the end. I am strong in my belief that stiff discipline and tough training eliminates the unfit.

When a company undertakes to put a young man through an expensive apprenticeship training course, there should be some form of written contract between them outlining the duties of each. I feel, however, that there should be a probationary period through which the youngster would be given a trial to see whether he was suitable for the work. Find out in a hurry if he has the know-how, the temperament, and the sense of right and wrong so that he can govern his actions in the future relative to his thinking about the rela-

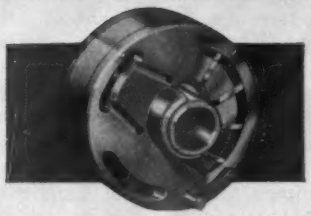
"Let's face it, boss—I'm just not cut out for this kind of work."

Question: Why are VICKERS Balanced Vane Type Pumps the most widely used oil hydraulic power pumps?

HUNDREDS OF THOUSANDS ARE RUNNING EVERY DAY


OUTLET
TRUE CIRCLE ARCS BETWEEN PORTS PREVENT RADIAL VANE MOVEMENT WHILE PUMPING LOAD IS IMPOSED UPON VANE
BRONZE ROTOR BEARINGS PROVIDE SUSPENSION INDEPENDENT OF OUTSIDE SHAFT LOADS
PUMPING PRESSURES WHICH WOULD OTHERWISE PRODUCE BEARING LOADS ARE CANCELLED OUT BY EQUAL AND OPPOSING PRESSURE AREAS (PORTS P-P1 AND X-X1)
VANES
ROTOR ROTATED BY A "FLOATING" SPLINE DRIVE
INDEPENDENT SHAFT BEARINGS
INLET

Answer: Because of their SUPERIOR PERFORMANCE and MANY OTHER BENEFITS for the user.



For more than two decades, the Vickers Balanced Vane Type has held the leading position among hydraulic power pumps . . . growing steadily in popularity. The various models (see below) are *the most widely used of all pumps in oil hydraulic service.*

Above is the pumping cartridge which is one of this pump's distinctive features. The many advantages listed at the right merit the thoughtful attention of anyone concerned with the selection and use of oil hydraulic pumps.

VICKERS INCORPORATED

DIVISION OF SPERRY RAND CORPORATION

1410 OAKMAN BLVD. • DETROIT 32, MICH.

Application Engineering Offices • ATLANTA • CHICAGO CINCINNATI • CLEVELAND • DETROIT • HOUSTON • LOS ANGELES AREA (El Segundo) • MINNEAPOLIS • NEW YORK AREA (Summit, N. J.) • PHILADELPHIA AREA (Media) PITTSBURGH AREA (Mt. Lebanon) • PORTLAND, ORE. ROCHESTER • ROCKFORD • SAN FRANCISCO AREA (Berkeley) • SEATTLE • ST. LOUIS • TULSA • WASHINGTON WORCESTER

IN CANADA: Vickers-Sperry of Canada, Ltd., Toronto

COMPLETE HYDRAULIC BALANCE—Each inlet and outlet port is balanced by another equal in size and radially opposite . . . pressure-induced bearing loads are thus eliminated. Pressure-balanced porting plates maintain ideal running clearances.

FLOATING SPLINE DRIVE—Rotor is driven by a "floating" spline. Rotor and shaft have separate bearings . . . avoiding strain from drive misalignment.

TRUE-CIRCLE CAM ARCS between ports prevent radial vane movement while pumping load is imposed upon vanes. Wear between vanes and rotor is thus practically eliminated.

ABILITY TO TOLERATE DIRT—Clean oil is of great importance in a hydraulic circuit; but, in spite of care, dirt sometimes gets in. The Vickers Vane Type Pump will pass a reasonable amount of dirt without trouble and without grinding it up.

REPLACEABLE CARTRIDGE—Cartridge (illustrated above left) contains all pumping parts that move . . . none contact the housing. Working parts can be removed and inspected without disconnecting piping or drive coupling. Replacement cartridge kits are available and pumps need not be sent to the factory for repairs. Pump capacity can be changed by simply changing cartridge in the field.

HIGHER EFFICIENCY—Tests prove exceptionally high volumetric and overall efficiency . . . not only when pump is new but also after long service.

AUTOMATIC WEAR COMPENSATION—Vanes are held in contact with the cam ring by centrifugal force and hydraulic pressure. If wear occurs, vanes revolve in a slightly larger orbit without appreciable change in performance.

MINIMUM MAINTENANCE—Hydraulic balance . . . floating spline drive . . . independent bearings . . . automatic wear compensation eliminate the most important causes for maintenance and repair.

TEMPERATURE ADAPTABILITY—Correct running clearances are automatically maintained which compensate for wide variation in oil viscosity resulting from temperature variation.

LONGER LIFE—The numerous features mentioned above that keep down maintenance also contribute to longer life. Then, a new cartridge completely rejuvenates the pump.

CONSTRUCTION SIMPLICITY is evident from the illustrations above. This simplicity is another reason for the superiority of Vickers Vane Pumps. For further information, ask for Bulletin 5002A.

7182

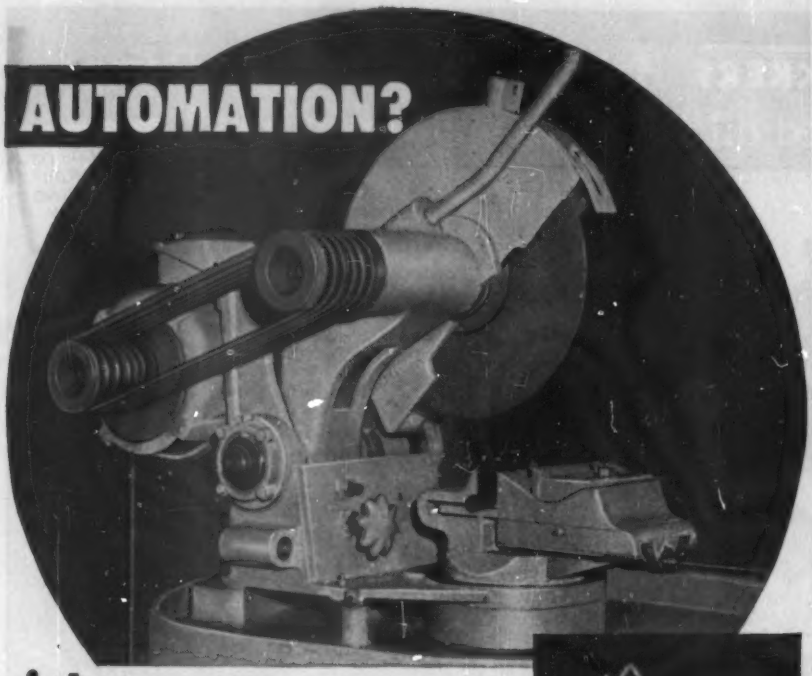
ALL MODELS HAVE THE VICKERS ADVANTAGES MENTIONED ABOVE

Single Stage. Pressures to 1,000 psi. Capacities to 55 gpm.

Two Stage. Pressures to 2,000 psi. Capacities to 55 gpm.

Double Pump—Two pumps for separate circuits driven by common shaft.

Two-Pressure Pump automatically delivers larger volume at low pressure and smaller volume at high pressure.



it's yours

TO ANY DEGREE WHEN YOU *specify* THIS

MODEL 48-W BRIDGEPORT ABRASIVE CUT-OFF MACHINE

Here's why . . .

- Air cylinder and hydro-check actuates head . . . saves labor and reduces wheel costs. (16" dia. wheel).
- Vise operates by air cylinder . . . integrated head, vise operation is excellent safety feature.
- Feeding mechanism which grips material to be cut, moves it into position.
- A series of micro switches tie above operations into smooth cycle which repeats automatically.
- Stainless steel spindle with Grease Sealed bearings.
- Coolant applied equally to both sides of cut.
- Vise holds *both* ends of piece being cut.
- Abundant power supplied by 7½ H.P. motor.
- Swivel head for accurate angle cutting.
- Accurate counterbalance of head by location of motor.
- Heavyweight for long life and efficient operation.
- *Complete automation* produces close tolerances, increases production, saves labor.

LOBDELL has a *complete line* of BRIDGEPORT Cut-Off Machines to suit every need. *Write for further details.*

LOBDELL DIVISION

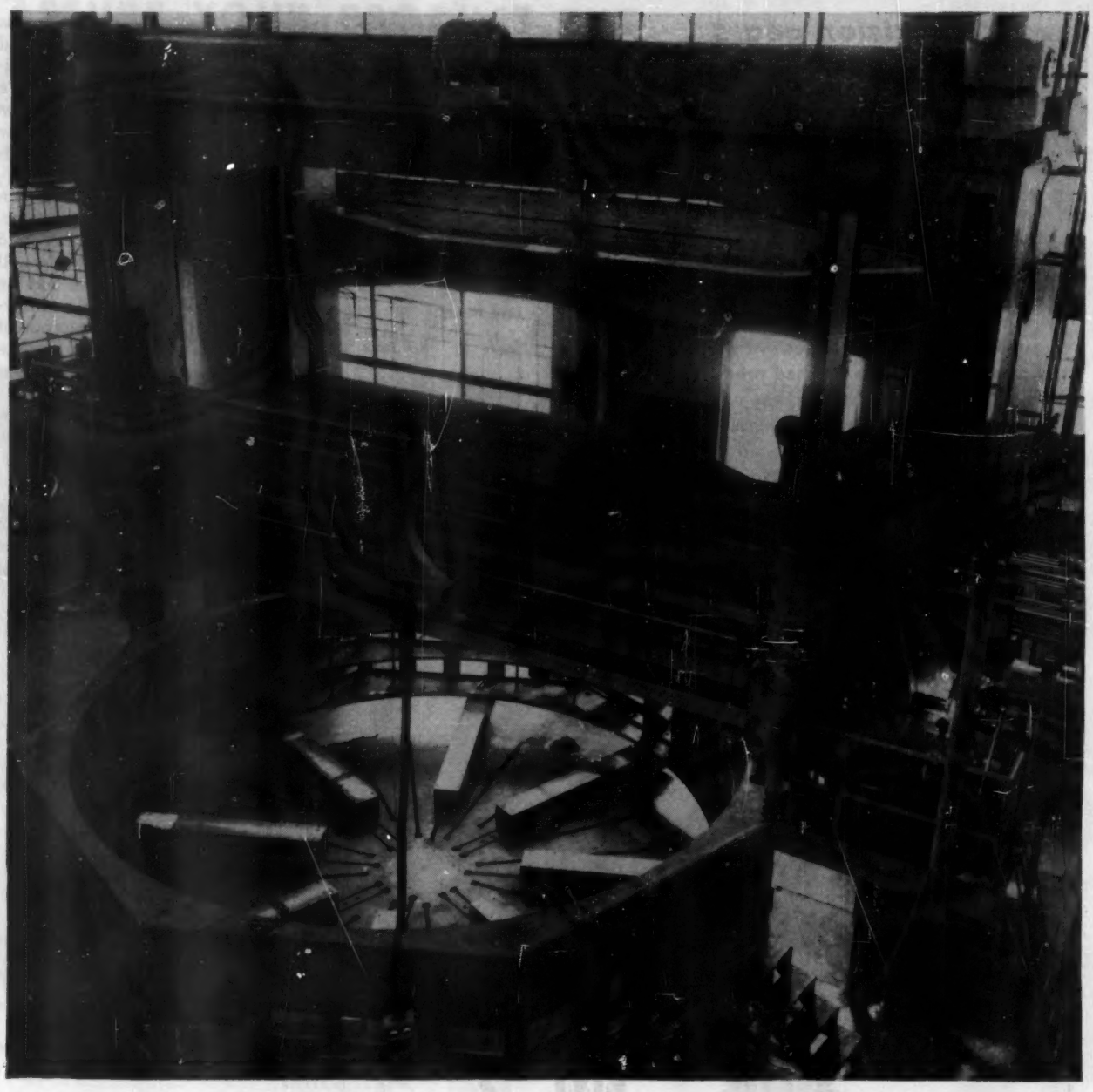
UNITED ENGINEERING AND FOUNDRY COMPANY

WILMINGTON 99, DELAWARE

tionship between employee and employer. All this for the benefit of the employer, who would otherwise be tied down with someone who was decidedly unfit. There is the possibility that the youngster would feel dissatisfied with the work after he got going and regret his move to take it up. It is after this period of trial that definite, binding agreement should be made between the two.

It has always seemed strange to me that the old "four-year" period was adhered to. How can one state definitely an amount of time to cover a training period when so many progressive innovations continually come to our attention. It is true that four years seems to be inborn in us. In my days an apprenticeship covered four years of fifty to sixty hours a week whereas today we work only forty. In terms of hours we can strike off approximately twenty-five percent. Maybe the educational facilities and shortcuts in production methods available could compensate for this shortening of working time wherein the apprentice would advance to the status of a journeyman. It is my honest opinion that an apprenticeship of two years' duration in one of the modern plants, equipped as they are with all the modern new equipment of production and inspection, is superior to the hell-bent-for-election methods prevalent in the days when I struggled to learn the machinist trade. About all we learned to do which required skill was to use calipers, and became toughened to think our way through and out of difficulties. We learned the hard way by not staying on the job too long, and skipping around for more

"All right! Who forgot to shut off his machine last night?"



35-year-old Niles mill sells Elliott new Niles 30-ft. boring mill

The remarkable performance since 1920 of a Niles 20-ft. vertical boring mill was responsible for Elliott Company's selection of a new, modern Niles 30-ft. mill. Installed primarily for machining blowers, turbines and condensers built at their Jeannette, Pa. plant, and large generator stator frames for their Ridgeway Division, this large vertical boring mill is also available for outside contract work.

The new Niles has a 16-ft. clearance under the crossrail. It's equipped with two 9-ft. travel rams and a 19-ft. 6-in. table. Other features include electronic feed control and electrically operated clamps which minimize set-up time and hold settings rigidly accurate. Over-counterweighing the rams takes up backlash in the feed gears at all times, thus insuring dimensional tolerances within .001 and .002 to be maintained across large surfaces.

Elliott also expects to use such other features as compound feeding and 60° swing of the boring rams to install electronic-hydraulic duplicating equipment on the mill. This will enable them to do contour or profiling work, thus increasing the machine's versatility and adaptability for a wide variety of work.

You too will find these exclusive features of Niles machine tools all add up to greater production and higher quality. For further details write today for our new eight-page booklet. Hamilton Division, Baldwin-Lima-Hamilton Corporation, Hamilton, Ohio.

BALDWIN BLH LIMA-HAMILTON

Hamilton Division
BALDWIN-LIMA-HAMILTON

Precision gears custom-made by Perkins
meet your specs
and *your time-table*

Throughout industry, the name PERKINS in association with GEARS has long been symbolical with quality and service. Hence — be they washing machines or supersonic aircraft engines — if the component gears of the finished product are *custom-made by Perkins*, they will be *better* products. *You furnish the specifications, we'll produce the gears!*

PERKINS MAKES in all materials, metallic or non-metallic, and in any size, to your specifications: helical gears, bevel gears, sprockets, ratchets, worm gears, spur gears with shaved or ground teeth, ground thread worms.

NOTE: The **PERKINS PRECISION SPRING COILER** is the latest development in the spring coiler field and eliminates entirely the use of arbors and long set-up time. It is a complete self-sufficient machine and enables you to make the spring you want *when* you want it — in seconds. The coiler produces any type of spring, in any diameter and any pitch with this range: Wire Sizes .005 to .125. Diameter from 3/32" to 12" and larger. Size of the compact coiler is only 7½ x 16". **A POWER MODEL** mounted on a welded steel console cabinet base is also available. Full information on request.

Perkins Machine & Gear Co.
101 Circuit Ave., West Springfield, Mass.

experience. Now, the apprentice has the red rug rolled out for him and his shop is equipped with every modern device for his convenience. We had to walk to a window in order to get our pay envelope but now they bring around a check on a silver platter!

It is decidedly unfair for an apprentice to pull out after he has acquired sufficient information and skill to carry on in a fashion. He will benefit from the experience but he will lose out eventually in not having acquired a complete course of training. There are so many people now going around claiming to be experts in this and that when, if the truth were known, they are half-cocked bluffers having had a chance contact with similar experiences. Somehow or other, on account of the press of a foreman's time, many of these industrial leeches get by in a fashion and gain a little experience at the employer's expense—and at the expense of the better trained worker whose pay is regulated by the efficiency of the production unit of which he is a part.

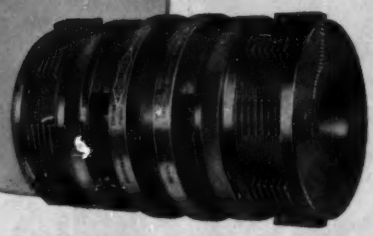
It is only natural that when an apprentice sees what some newcomers can get by with that he asks himself if he couldn't do the same thing by pulling out to another shop and taking a chance himself. He'll get better pay, no doubt, and he will acquire some valuable experience of a different variety, but if he does not stick along with the original plan the chances are that he will grow into a one-sided worker himself. He is weakening his character by not sticking with that which he started out to accomplish. This offsets the gain he makes in an increase in pay, believe it or not.

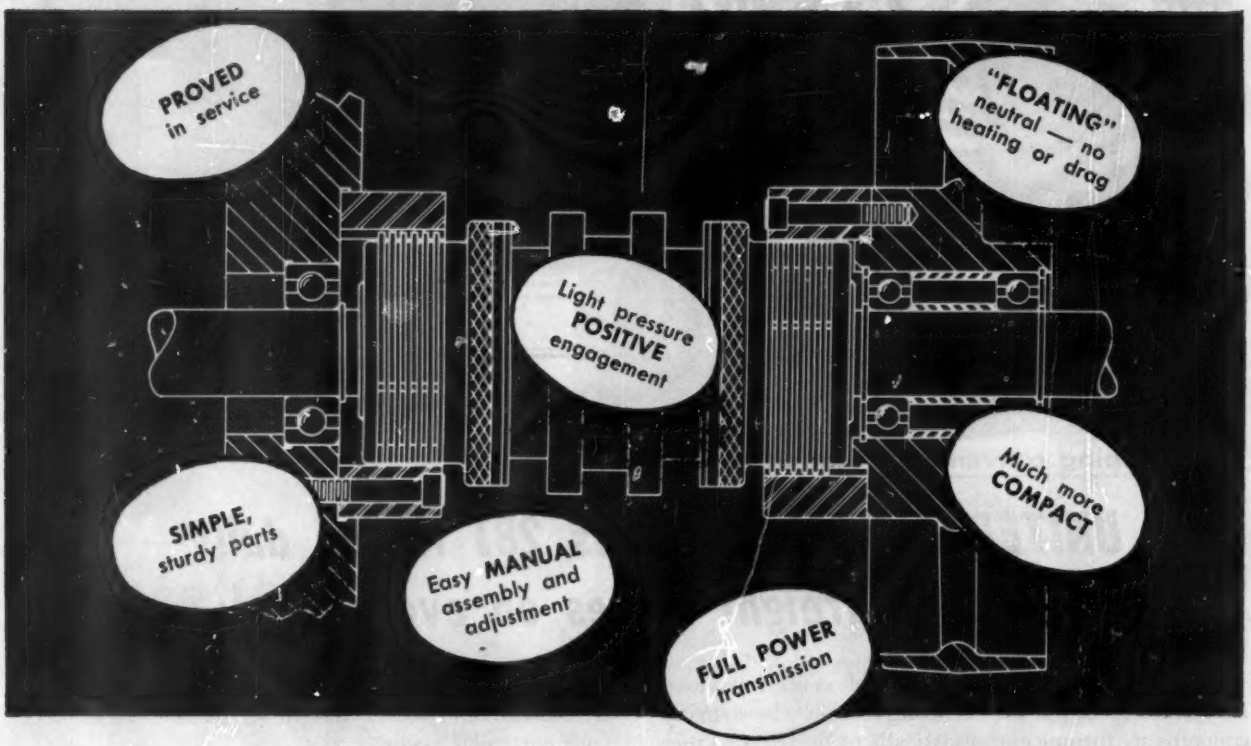
J Homewood
Burbank, Calif

"And if you should forget how to operate it, just give me a call."

ASSURE YOUR PRODUCT THE *PROVED* SUPERIORITY OF A

MAXITORQ *floating disc* CLUTCH

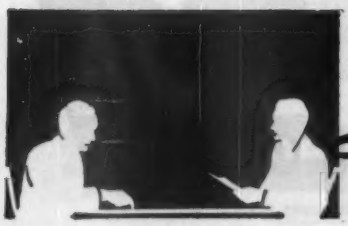



PROVED in service
"FLOATING" neutral — no heating or drag
Light pressure POSITIVE engagement
SIMPLE, sturdy parts
Easy MANUAL assembly and adjustment
FULL POWER transmission
Much more COMPACT

The line drawing shows typical application of a double Maxitorq Floating Disc Clutch, arranged for both drive and brake, with ring-type driving cups.

Such installations have a well-proved record of efficiency and freedom from maintenance. Drive and brake engagement and disengagement are smooth and positive . . . without drag or heating . . . because exclusive MAXITORQ design assures that discs ride free in neutral.

MAXITORQ Floating Disc Clutches are available in a wide range of sizes and types . . . single, double, overload release . . . to meet specific installation demands. Our engineering department also stands ready to help you solve special drive problems. Write or phone Dept. AM-12. The Carlyle Johnson Machine Company, Manchester, Conn.



Let's talk **MAXITORQ**

8CJ55

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UNITED AIR LINES makes 281 flights daily— and air freight moves on every one!

Space dependability—because of central payload control for cargo—is one of the big reasons why so many concerns are turning enthusiastically to United Air Lines Air Freight as an everyday tool in the profitable operation of their business.

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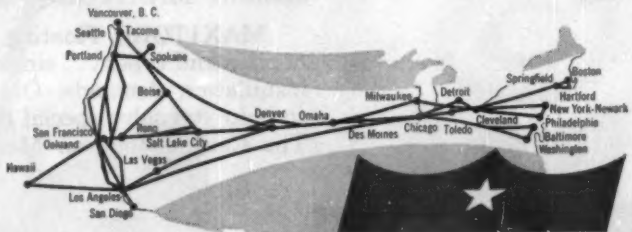

Call the nearest United Representative or write for free booklet, "Industry's Flying Partner." Cargo Sales Div., Dept. G-12, United Air Lines, 5959 S. Cicero Avenue, Chicago.

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PRECISION DESIGNED AND BUILT TO MEET THE REQUIREMENTS OF THE AGE OF AUTOMATION

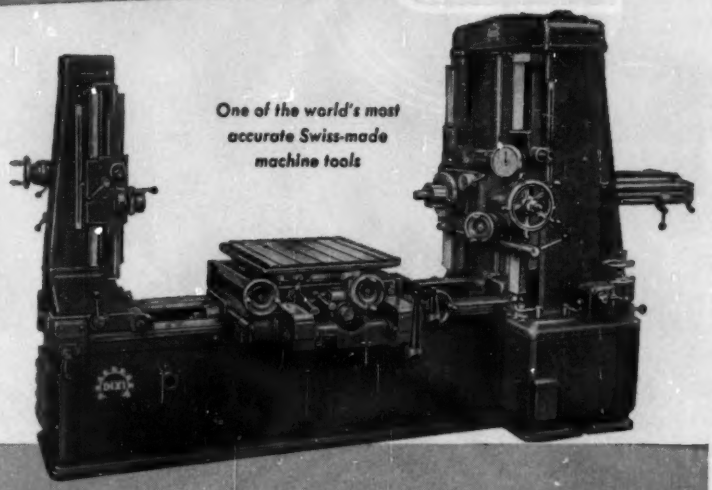
Dixi 60

Horizontal Jig Borer

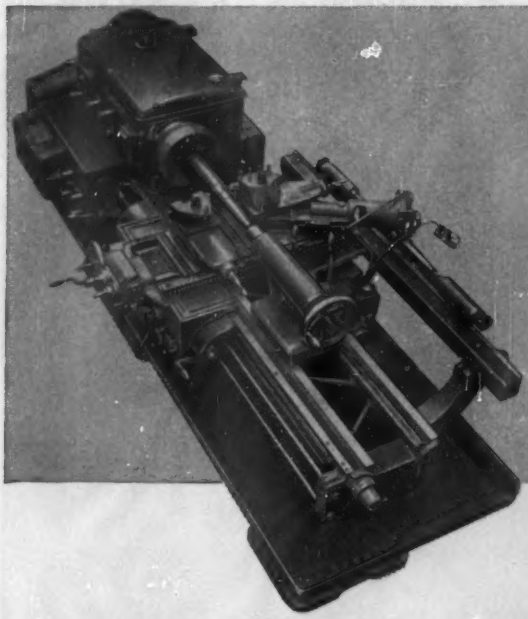
With 5 optical microscopes

A precision machine for boring, drilling, recessing, and milling work. Built-in rotary table with optical microscope can be rotated 360°. Headstock, column, and table settings by optical microscopes to insure overall accuracy of .0002". Table and spindle head have variable hydraulic feed. Mechanical spindle feed can be changed without stopping spindle and is provided with automatic depth stop.

No. 40 taper spindle. Spindle speeds 32-1350 R.P.M. Feeds .0015"—.010" per rev. Table size 28¾" x 32⅝" max. distance spindle to table 19¾". Table travel 23⅝". Spindle travel 24.4".



One of the world's most accurate Swiss-made machine tools



Heavy Duty Lathe ***High Precision, Reliability, Top Performance Schaerer Model UN-450***

Twin cross slides. Copies from cylindrical or flat template either longitudinally or cross. Twin slides permit rough turning and finish turning in the same operation in many instances. Swings 17¾" over bed, 9" over carriage, 20-5/64" over gap. Center distance 60". Spindle speeds 31.5 to 1400 R.P.M.

Hydraulic copying attachment can be removed to permit use as a regular twin slide lathe when necessary. 10 H.P. motor drive to spindle. Separate motors for coolant and hydraulic pump. A production lathe built to tool room standards.

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Automatic Transfer Line with 11 stations for machining connecting rods and connecting rod caps. 4 components are clamped simultaneously, giving an output of 325 rods and the same number of caps per hour.

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NEW Variac Low-Priced Speed Controls

for 1 and 1½ hp D-C Motors on A-C Lines

Four simplified versions of our popular 1 and 1½ hp Motor Speed Controls are announced. Both complete and stripped-down units are available at considerable reduction in cost, and include all of the operating features of other VARIAC® Controls:

Very Wide Speed Range — continuously adjustable from rated speed to zero. Full rated torque can be delivered at any speed without overheating.

No Electron Tubes — selenium rectifiers require no warm-up — motor starts immediately when power is applied.

New **Type 1704-B**
Variac® Motor Speed Control

Rectifier box can be mounted in any ventilated location (Overall dimensions: 20½ x 13⅜ x 5⅝ inches). Controller switch small enough to be mounted in frame of machine. VARIAC® speed-control transformer readily mounted adjacent to machine; has built-in overload breaker. Type 1705-B control is identical in appearance and size.

Type 1704-B for 1 hp d-c motors:	**$330.00**
Type 1705-B for 1½ hp d-c motors:	**$380.00**

Type 1704-BW (and 1705-BW) stripped down model identical with types 1704-B and 1705-B models except that user supplies controller switch for start-stop-reverse. Dynamic braking resistor incorporated in rectifier box.

Type 1704-BW for 1 hp d-c motors:	**$308.00**
Type 1705-BW for 1½ hp d-c motors:	**$358.00**

WE SELL DIRECT
Prices are net, FOB Cambridge or West Concord, Mass.

Excellent Starting Characteristics — delicate machines can be started without any jerking — heavy machines start very quickly.

Very Fast START-STOP-REVERSE — ample capacities permit heavy loads to be started, stopped and reversed repeatedly without damage.

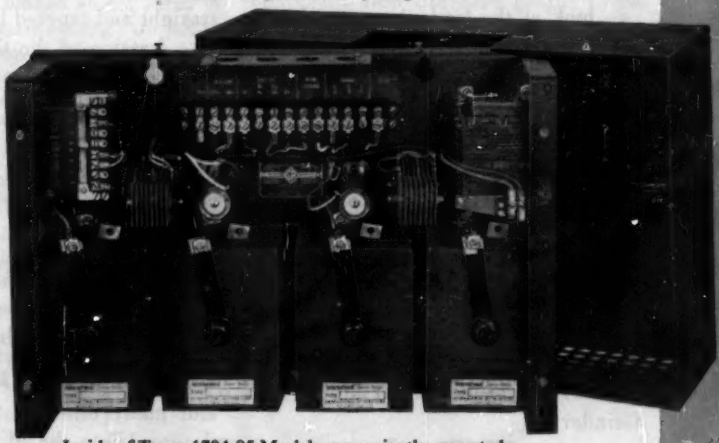
Extra-Smooth Torque — satisfies most critical requirements for low torque pulsation — excellent for such applications as precision grinding.

Effectively Eliminates Need for Multi-Step Gears and Pulleys, or other mechanical speed changers. ANY speed desired can be obtained.

Very Long Life with minimum routine maintenance — no tubes to replace.

Low Cost • Simple Installation • Easy Maintenance

New **Mounted Models,** complete, include: ☆ A drum-type controller for START-STOP-REVERSE, with dynamic braking contacts, cam-type switch designed for fast break, little sparking and long life ☆ A Variac® continuously-adjustable auto transformer for speed control. Klixon-type circuit breaker with suitable time delay is incorporated in the Variac® case handy to the operator for resetting. ☆ Rectifier chassis carries rectifier stacks and built-in dynamic braking resistor. Substantial dust cover is readily removable for inspection. ☆ Line switch or cutout box is the only accessory required.



Inside of Types 1704-05 Models conveniently mounted on wall or in machine — no electron tubes — wiring terminals plainly marked — easily removed dust cover.

GENERAL RADIO Company

275 Massachusetts Avenue, Cambridge 39, Massachusetts, U. S. A.

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920 S. Michigan Ave. CHICAGO 5 • 1000 N. Seward St. LOS ANGELES 38

Suitable D-C motors for use with these controls can be obtained from General Radio Company. The 1 hp Motor is cataloged as Type MOD-9 and is priced at $185.00. The 1½ hp Motor is Type MOD-10, at $210.00.

The Machine Tool The User Boasts About

ROYAL OAK
HAS THE
FACILITIES
THAT
PAY OFF
IN DIE,
JIG, GAGE
AND
FIXTURE
QUALITY
Jig grinding is an operation that enables Royal Oak to produce gages, jigs, and other precision work to closest tolerances and quality finish. This Moore Jig Grinder, with offset provisions and special attachments, grinds internal and external surfaces and contours.
ROYAL OAK TOOL AND MACHINE CO.
29800 Stephenson Hy.
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REPRINT OF RECENT FRONT-COVER ADVERTISEMENT IN "TOOLING & GAGING"

The Moore Jig Grinder

Thumb through the next facilities booklet that comes across your desk . . . look at the trade journal advertisements stressing topflight facilities . . . chances are you'll see one or more Moore Jig Grinders featured prominently.

The Moore Jig Grinder has become the Cadillac of the toolroom (while remaining in a Chevrolet price range). It's a center of attraction on plant tours. The plant manager will point to it, beam like a new father showing snapshots of his offspring, and say: "And there's our Moore Jig Grinder!"

Why do so many users point with pride to the *Moore* Jig Grinder?

Because Moore invented the first jig grinder to relocate and grind straight and tapered holes to "tenths" in a fraction of the time required by other means.

Because the current No. 2 Moore Grinder extends this function to regular and irregular contours, making standard practice of former "trick" operations.

Because this machine employs the lead screw measuring system to assure accuracy, flexibility and speed.

Because electric heating elements and many other features have been designed into the Moore Jig Grinder to assure dimensional stability and wear resistance — and, consequently, *permanence* of accuracy.

Because it's the perfect partner for the popular Moore Jig Borer in achieving accuracy, speed and economies on countless toolroom and production jobs.

For complete information on the machine tool *the user* boasts about, write today for the Moore Jig Grinder catalog.

"HOLES, CONTOURS AND SURFACES
is bound to become a classic to the man or shop that does accurate work."
American Machinist Book Review
424 pages
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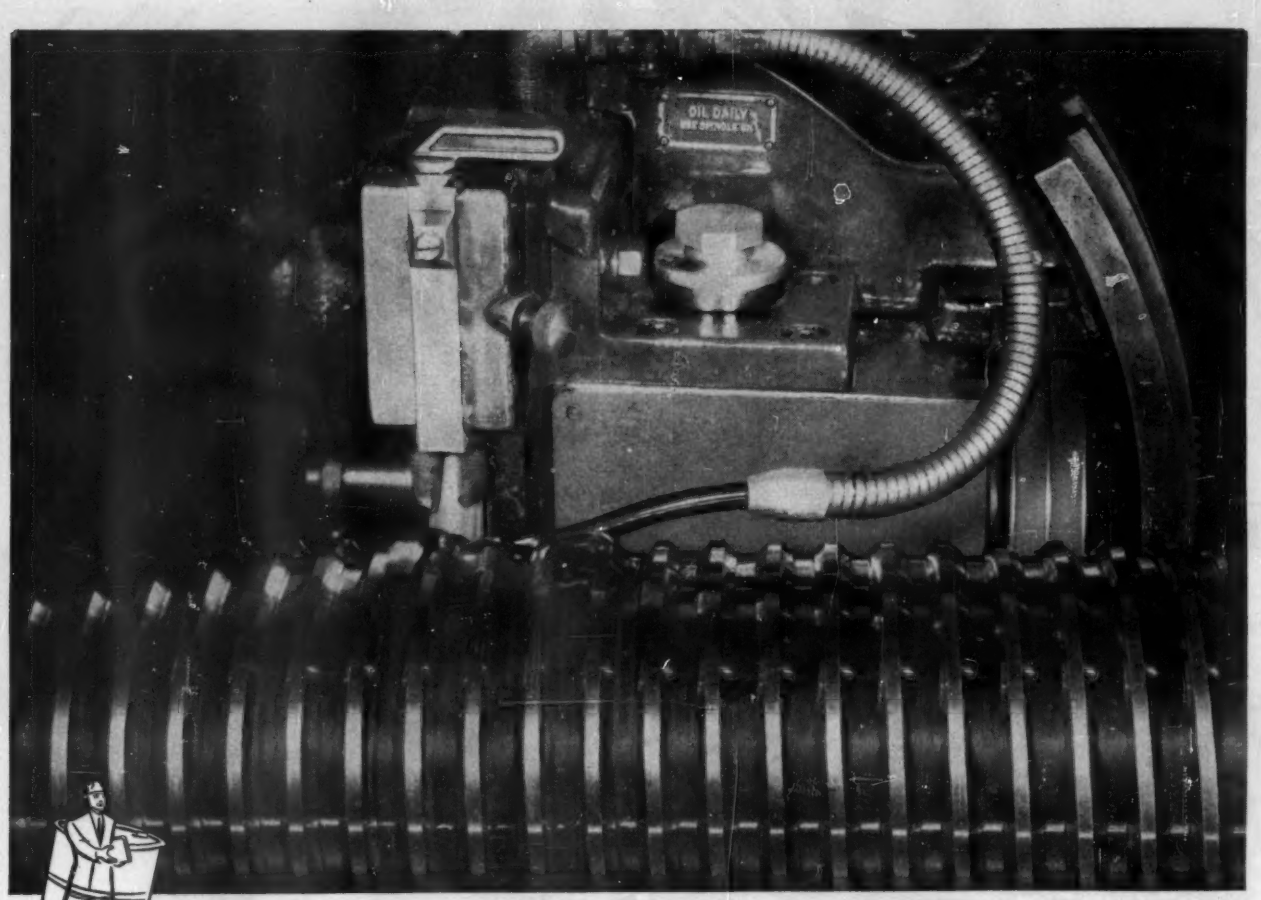
ADD MOORE SPEED + ACCURACY TOOLS TO YOUR TOOLROOM

JIG BORERS • JIG GRINDERS • PANTO-CRUSH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES



Ask "the Man in the Barrel" to tell you how . . .

A Grinding Oil can *make* or *break* precision grinding jobs!

If you're using *just a coolant* or any oil that happens to be handy for those precision grinding jobs . . . it's costing you money!

A grinding oil can make or break a precision grinding job such as thread grinding, gear grinding and many types of form grinding. Grinding oils are usually classified as "hard-acting" or "soft-acting" depending on how they affect grinding wheel hardness. Grinding oil characteristics must be closely co-ordinated with wheel characteristics, speeds, feeds, and material machinability and hardness to obtain maximum performance.

When form grinding low hardness materials, where wheel form is important, a "hard-acting" oil helps to maintain proper wheel form by making the wheel act harder. As a result, greater wheel life is obtained and more accurate parts are produced.

When a high hardness material is being ground there is a tendency for the wheel to load-up and glaze. Such a condition is the cause of burnt work surfaces and heat checks, and is often encountered when grinding taps, gauges and other hardened parts. A "soft-acting" grinding oil will make the wheel act softer, opening up the wheel and exposing new abrasive grains to do the work.

Stuart's complete line of grinding oils have been chemically balanced and scientifically tested to meet the demands of various types of precision grinding operations. "The Man in the Barrel," your trained Stuart Representative, will be happy to assist you in selecting the proper grinding oil for your particular needs. Ask to have him call . . . and ask for a Stuart's Precision Grinding Oil Bulletin, too.

D. A. STUART OIL COMPANY, LTD.
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Time Tested Cutting Fluids and Lubricants

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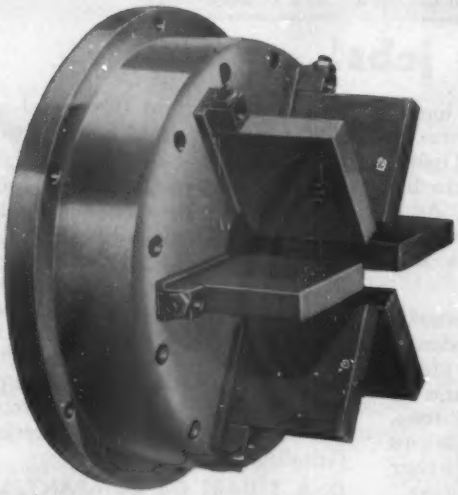
NOW WOODWORTH Standard (AIR-OPERATED) DIAPHRAGM CHUCKS

3 SIZES 5½"-7"-10"

24-HOUR DELIVERY



If you have a variety of simple chucking applications and want to be assured of the same top precision and fine quality ordinarily found only in Woodworth custom diaphragm chucks . . . order Woodworth "Standards" today! It's this easy: you simply bore the jaws to suit your part, make your own stop details and attach the air connection. Complete installation and operating instructions are furnished. Call your Woodworth representative or write for Woodworth Catalogue SC-56 for complete details.

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PRECISION INVESTMENT CASTINGS • PRECISION HEAT TREATING OF AIRCRAFT PARTS

THE DIFFERENCE... *Carpenter* stainless uniformity

These hinge pivot pins for automatic dishwashers were being turned out by "doing things the hard way." Tools had to be reground every eight hours. The ordinary Type 303 steel used wasn't uniform, refused to hold size, and didn't provide the required finish.

This job could easily have been chalked up as a "necessary headache," but someone wasn't satisfied . . . was willing to explore the possibilities for improvement. As a result, Carpenter Stainless No. 8 (Type 303) has brought these worthwhile changes: Tool regrinding is required only every 18 to 24 hours . . . final grinding of the part is eliminated because size tolerances were held so accurately . . . bar after bar machines the same . . . and each part now costs 50% less.

Build your own improvement program with the cooperation of Carpenter . . . originator of the first Free-Machining Stainless. The steel can be in your plant almost immediately if you call your nearest Carpenter Mill-Branch Warehouse, Office or Distributor now. *The Carpenter Steel Co., 109 W. Bern St., Reading, Pa.*

Specify Carpenter . . .
the one stainless job-proved to give you:

casier machining
fewer rejects
smoother finishes
lower production costs

Carpenter STEEL

Free-Machining Stainless Steels

IMMEDIATE DELIVERY from local warehouse stocks — Export Address: Port Washington, N. Y. — "CARSTEELCO"

2nd In a Series...

OF HIGH PRODUCTION CASE HISTORIES

ASK BAIRD ABOUT IT

CHECK THIS ONE FOR SPEED PLUS automation

THE MACHINE: Baird's famous 76H Automatic Chucking Machine.

THE PART: High-compression cast iron rotor hub.

THE AUTOMATION: Automatic loading and unloading in addition to full automatic machining cycle.

THE RESULT: 213 pieces per hour gross. The machine was set up single indexing. Its performance is typical of Baird Machines that are today the backbone of many famous high production lines. If you have a comparable job to do . . .

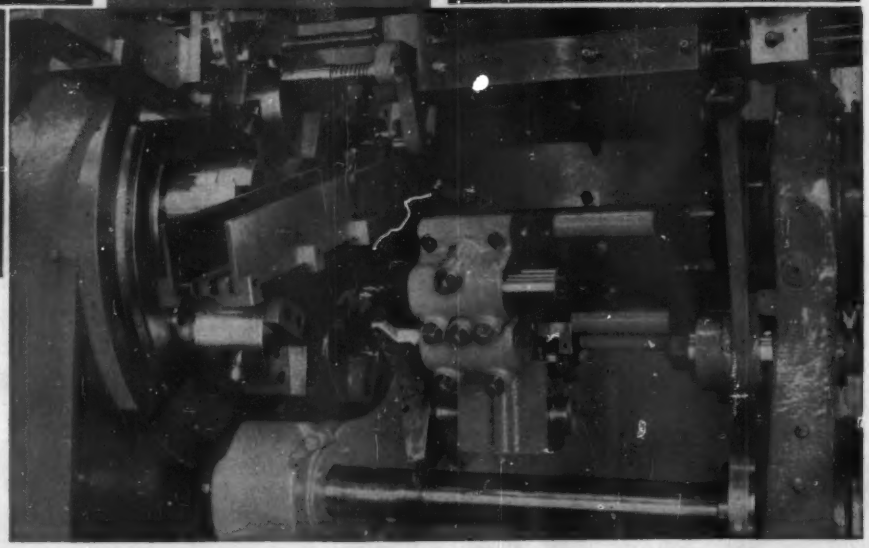
"Ask BAIRD about it"

Write Dept. AM

OPERATIONS:

Automatically load. Rough and finish turn O.D. Drill, true bore and ream the small hole concentric with O.D. Face and chamfer end. Chamfer holes. True bore the counterbore. Trepan bottom of counterbore and automatically unload. Illustrations also show rough castings as fed to machine.

(Above) REAR VIEW OF TOOLING



(Right) FRONT VIEW OF TOOLING
Showing load chute at upper left . . . and unload chute at center . . . both at same station.

THE BAIRD MACHINE COMPANY
STRATFORD CONNECTICUT

WHERE YOU WILL GET THE HELP OF SPECIALISTS ON THESE ESSENTIAL PRODUCTION PROBLEMS:

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FORMING MACHINES • AUTOMATIC PRESSES • TUMBLING BARRELS

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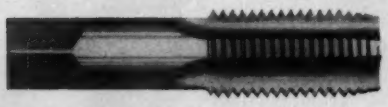
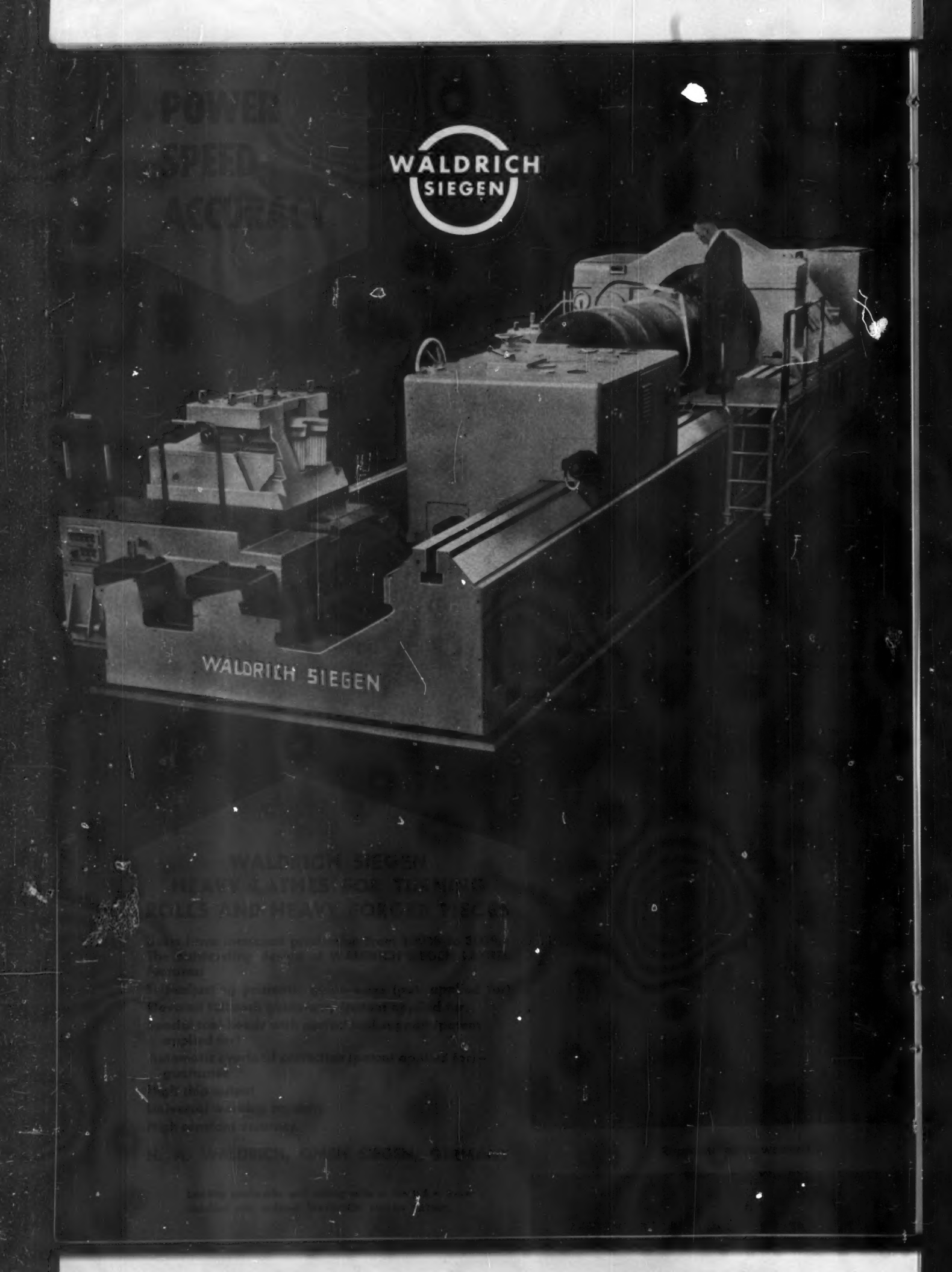
your best bet is to call your Bay State Distributor.
He backs up Bay State Quality and Service by
stocking and delivering the right Precision Performance Taps
when and where you want them. When you rely on his services
you can keep your inventory down and your production up . . .
tapping costs will drop and profits rise.
Make a note to call your Bay State Distributor today.



BAY STATE TAP & DIE COMPANY
MANSFIELD, MASSACHUSETTS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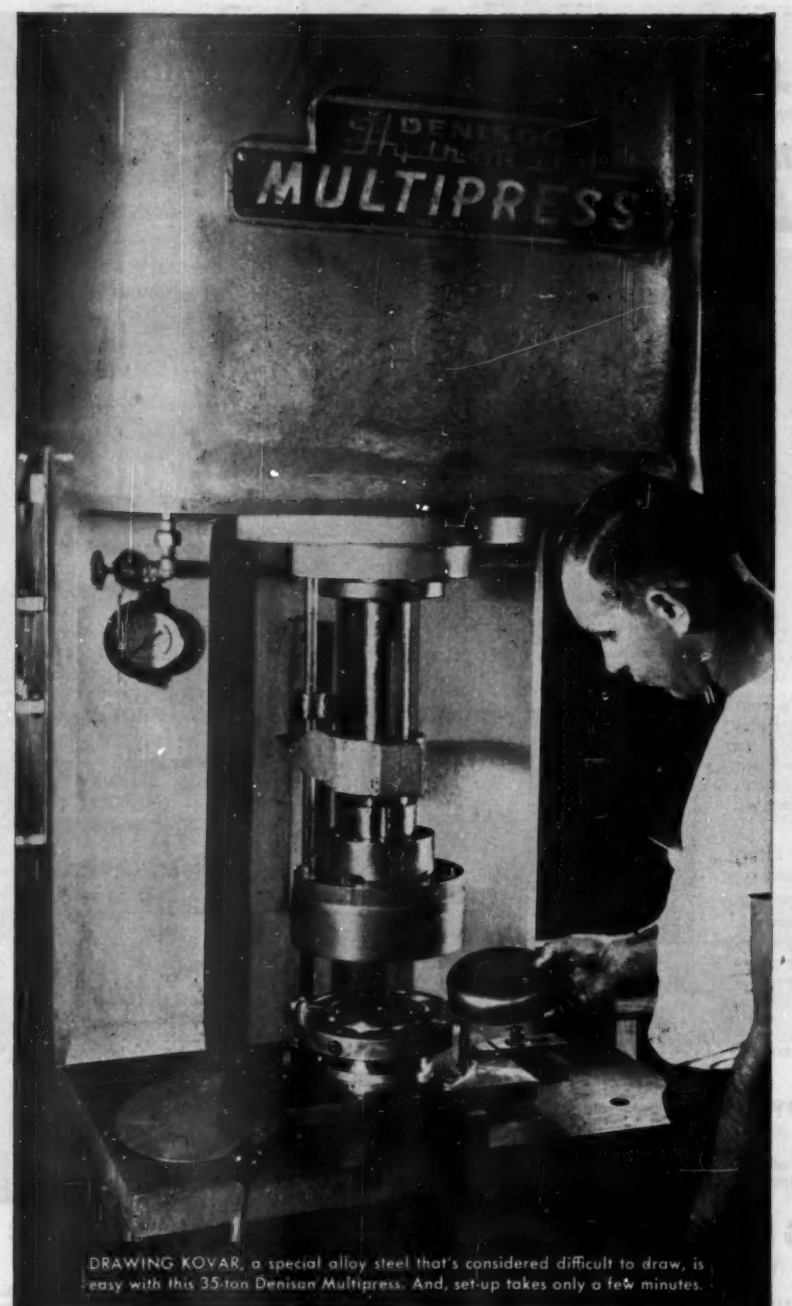
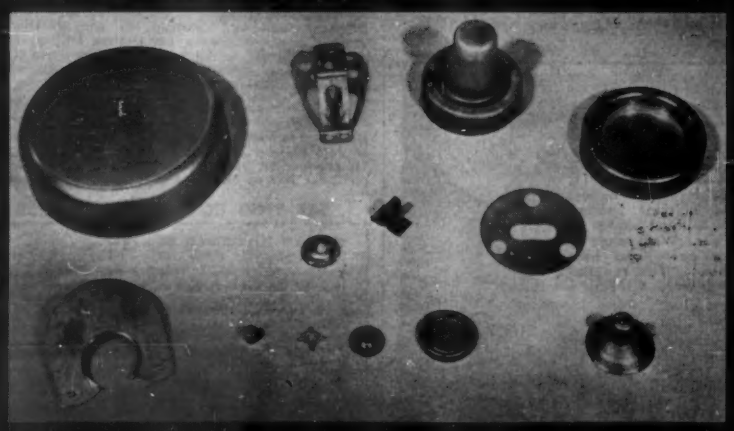


DRAWING KOVAR, a special alloy steel that's considered difficult to draw, is easy with this 35-ton Denison Multipress. And, set-up takes only a few minutes.



Some of the various electronic parts formed by Multipress at Amperex.

Quick die changes with DENISON MULTIPRESS® saves manhours

A way to cut costs on short-run metal-forming

SHORT RUNS, frequent die changes. That was the production problem at Amperex Electronic Corporation, Hicksville, New York.

Now, Denison hydraulic Multipress makes set-ups faster than possible with fixed-stroke presses. With Multipress inching control, the ram can be inched to the convenient point for attaching dies. And the smooth, variable hydraulic stroke gives set-up men perfect control of the ram.

Amperex uses three Multipresses for blanking, piercing, forming, drawing and broaching steel and nonferrous metals . . . to produce a wide variety of shapes and sizes.

This is one example among many where Multipress is cutting costs in the 1-to-75-ton pressure range. For help on your particular application, call a Denison Hydraulic Engineer.

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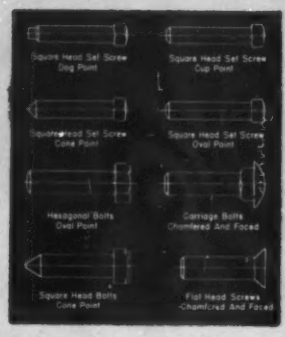
PUMPS • MOTORS • CONTROLS

ECONOMY Automatic Pointing Machines

Save Time and Money!

TYPE 3300


Square Head Set Screw Dog Point
Square Head Set Screw Cup Point
Square Head Set Screw Cone Point
Square Head Set Screw Oval Point
Hexagonal Bolts Oval Point
Carriage Bolts Chamfered And Faced
Square Head Bolts Cone Point
Flat Head Screws Chamfered And Faced

Typical parts machined on the TYPE 3300

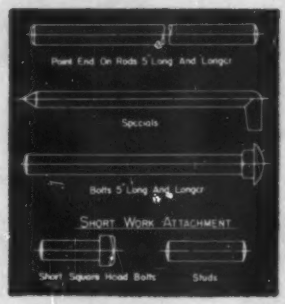
ECONOMY Automatic Pointing Machines are hopper fed and automatic in operation. These features enable operator to run several machines resulting in greater productivity and lower costs.

These Automatic Pointers are available in two sizes—Type 3300 for uniformly pointing bolts and screws to 3/8" diameter and 3/4" to 3-1/2" in length, the type 4600 for pointing bolts and cap screws 1/4" to 3/4" diameter and 1" to 6" in length. A single machine will handle all types of points on many types of bolts and cap screws.

Production rates of the type 3300 vary infinitely from 2,000 to 6,000 finished parts per hour and on the type 4600 from 1800 to 5400 per hour.

Also available is the type "P" Semi-Automatic Pointing Machine for pointing bolts, cap screws, studs and rods 1/4" to 1-1/2" diameter, 5" or more in length. Production rates up to 2,000 pieces per hour make it a valuable secondary machine for short runs.

Consult ECONOMY on low cost, high production Bolt and Screw Pointing operations.



Typical operations performed on TYPE "P" Semi-Automatic Pointing Machines

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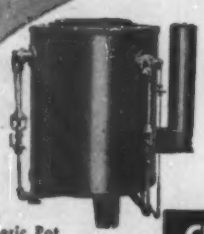

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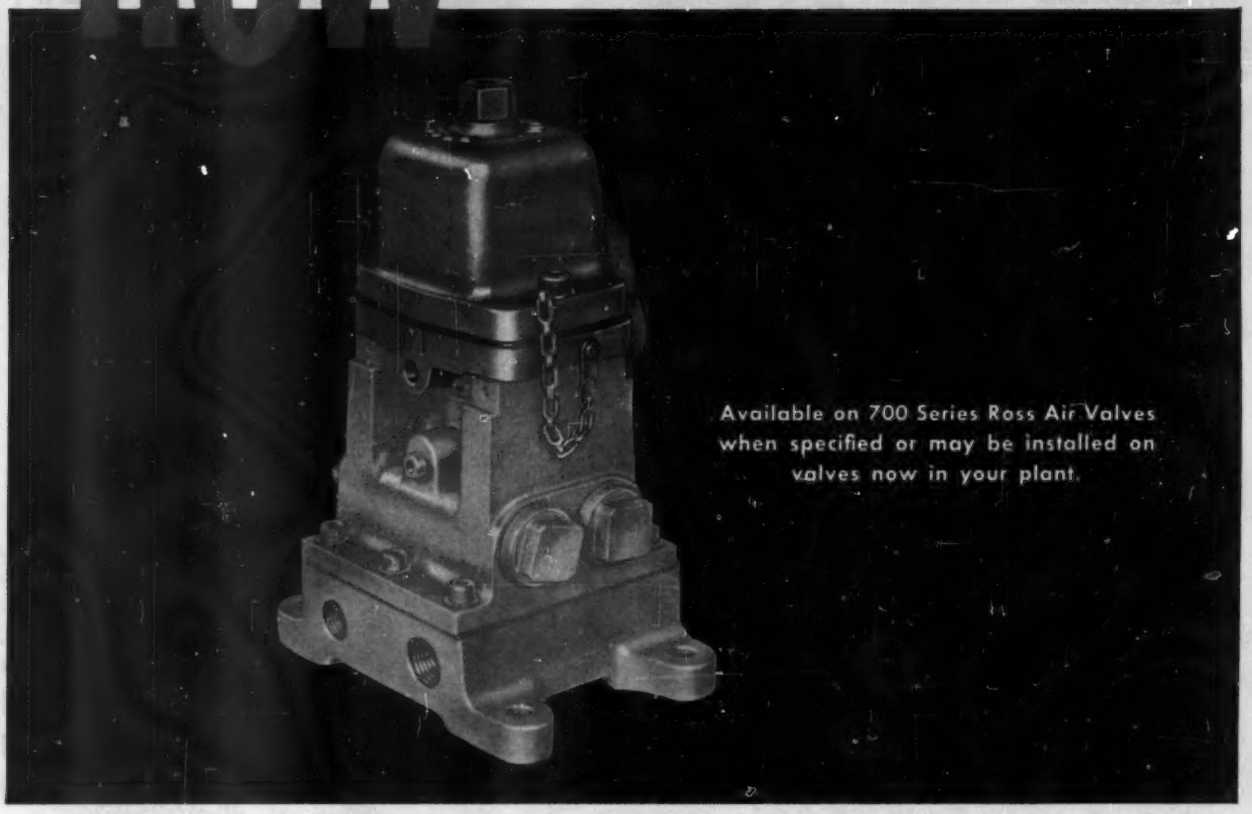

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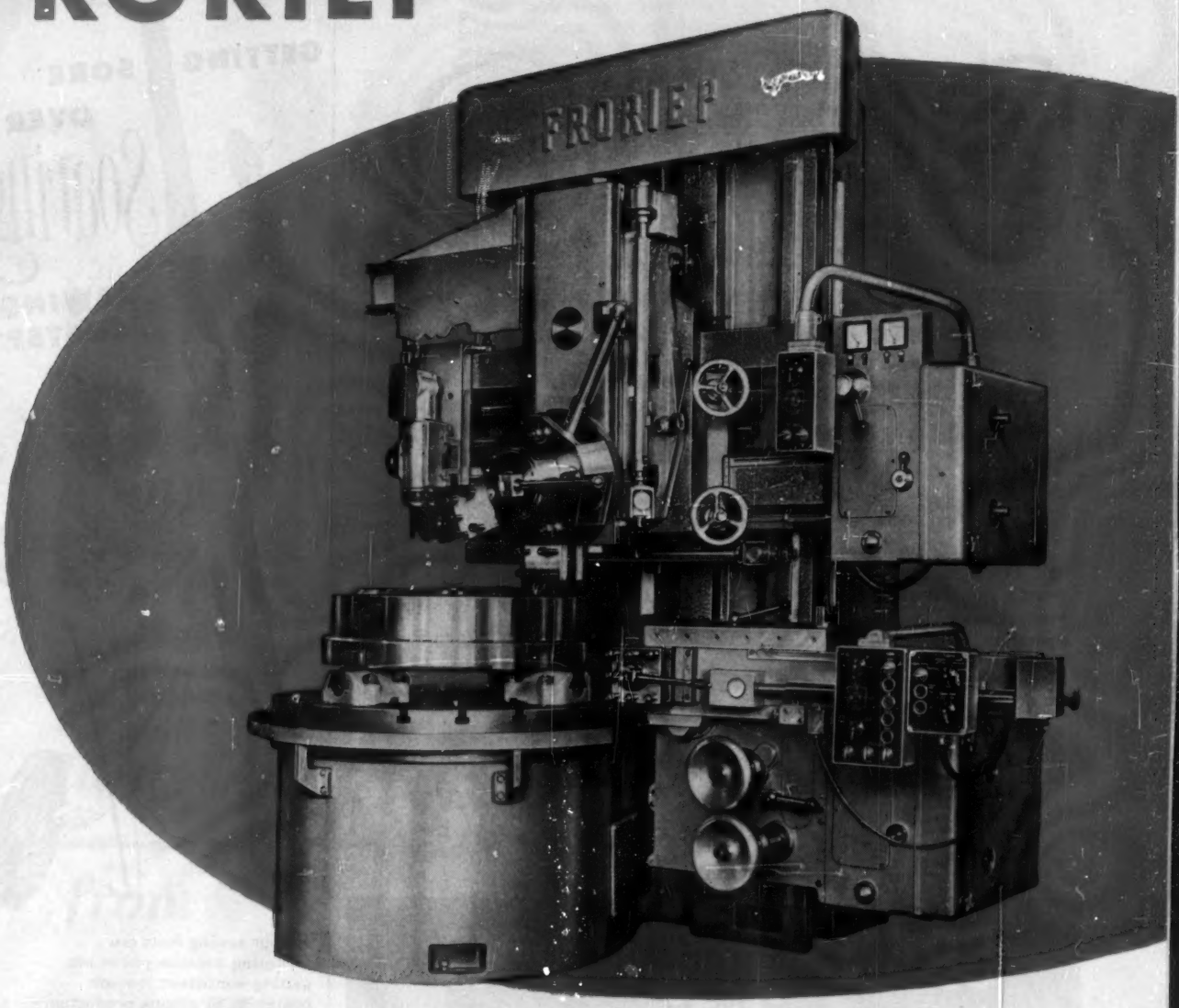

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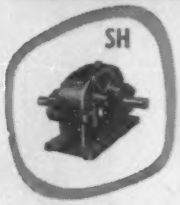

The *real* criterion for reduction units is unfailing performance over the years, with minimum maintenance. Our files show many cases where Grant Reducers are still providing every-day service, after two decades, without a breakdown.

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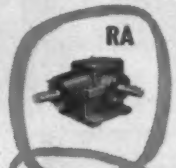

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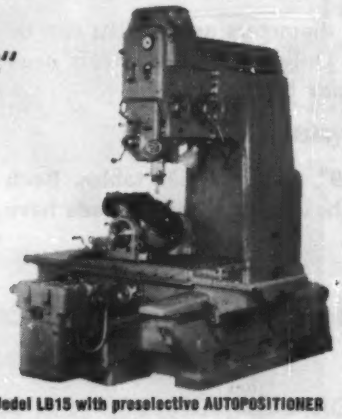

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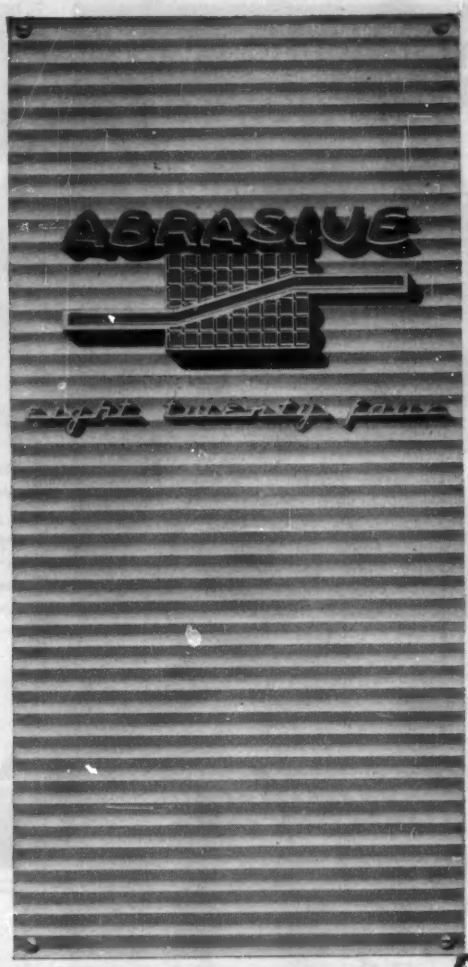

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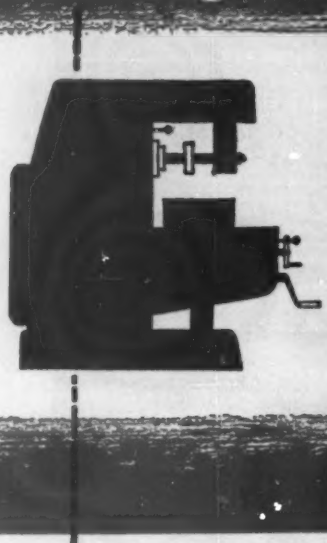

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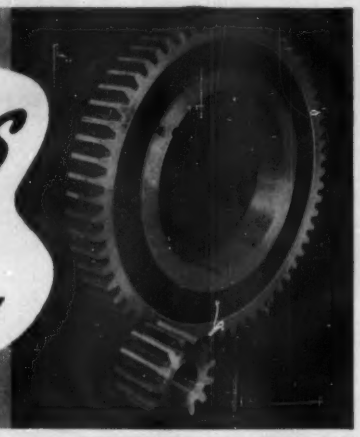

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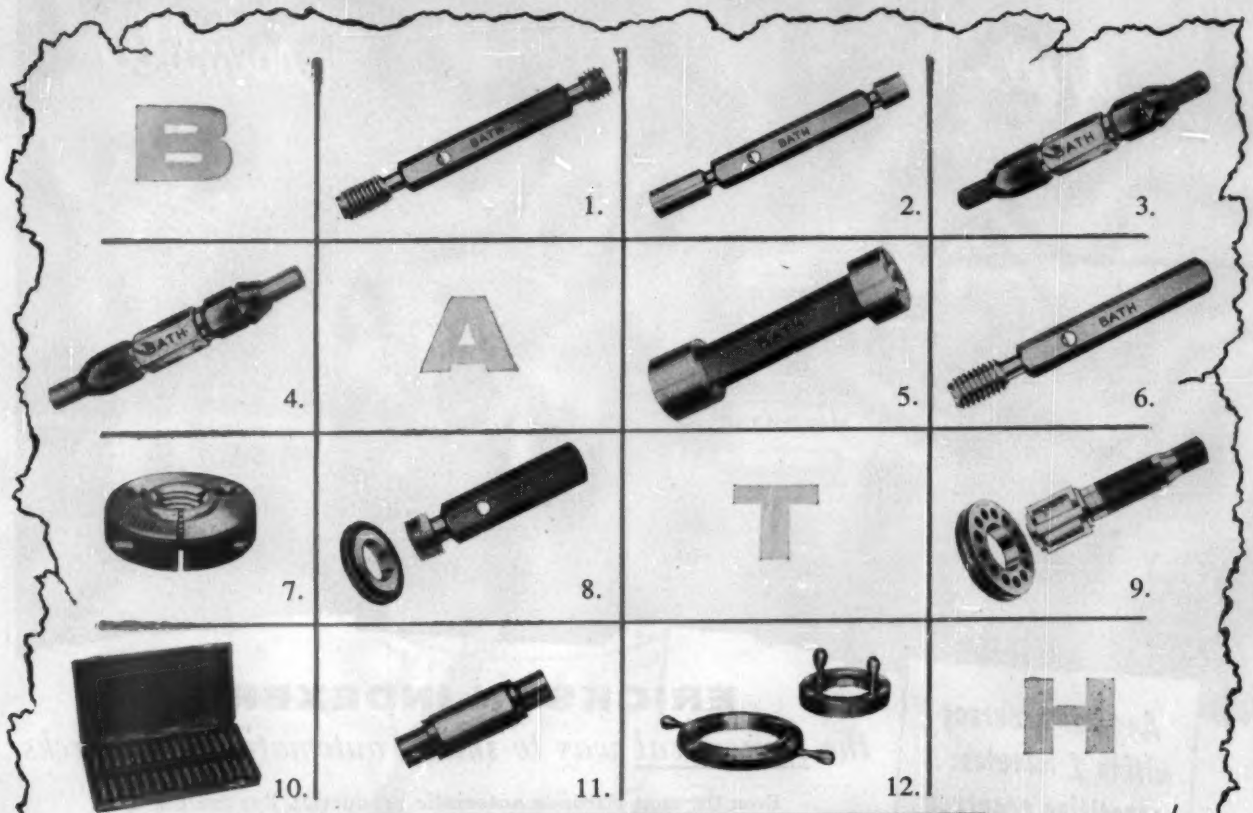

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(Reverse the page for correct answers).

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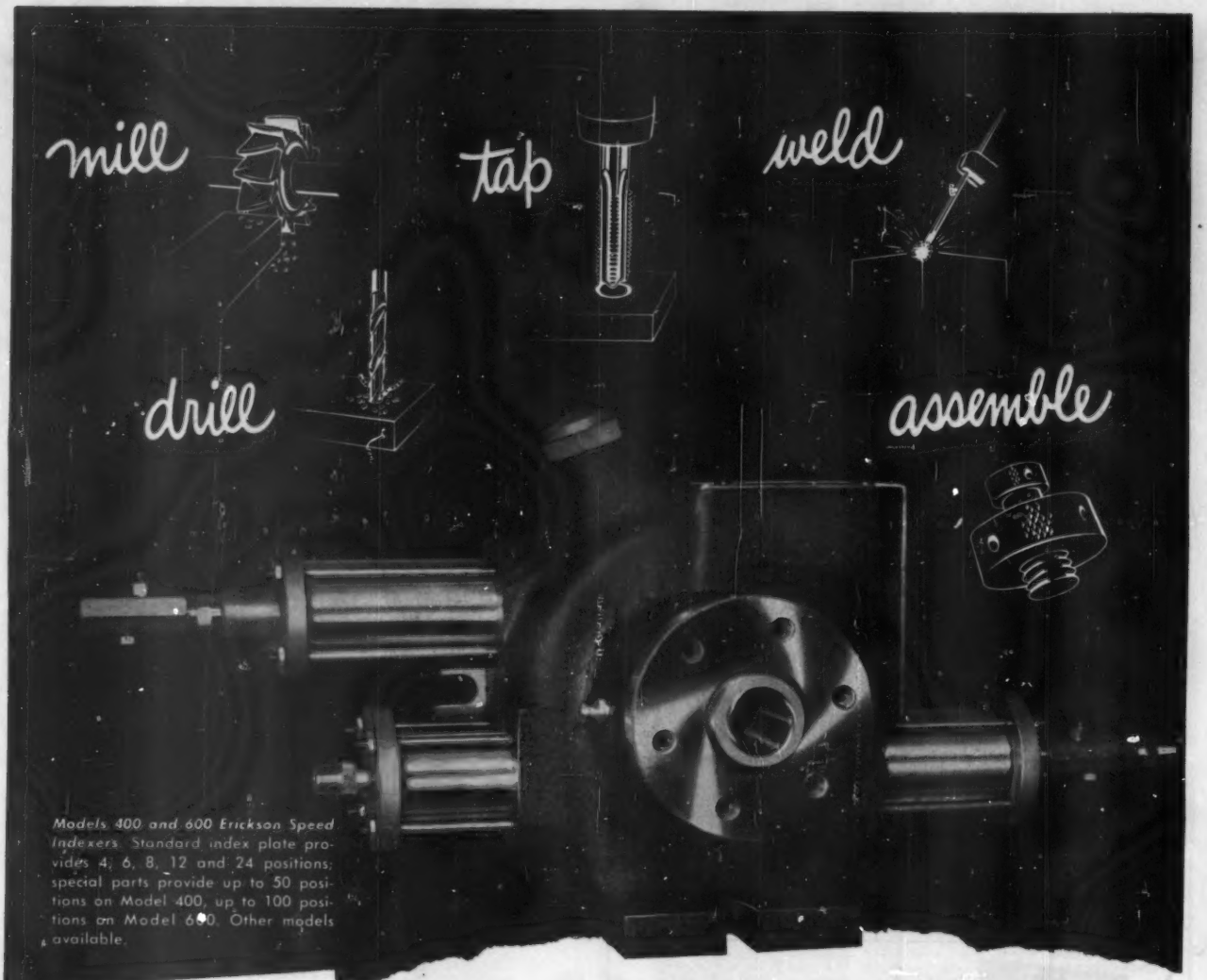

Models 400 and 600 Erickson Speed Indexers. Standard index plate provides 4, 6, 8, 12 and 24 positions; special parts provide up to 50 positions on Model 400, up to 100 positions on Model 600. Other models available.

Angular accuracy within 2 minutes... repetitive accuracy in low "tenths" of a thousandth

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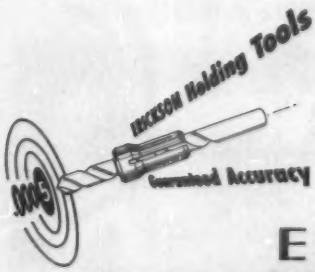

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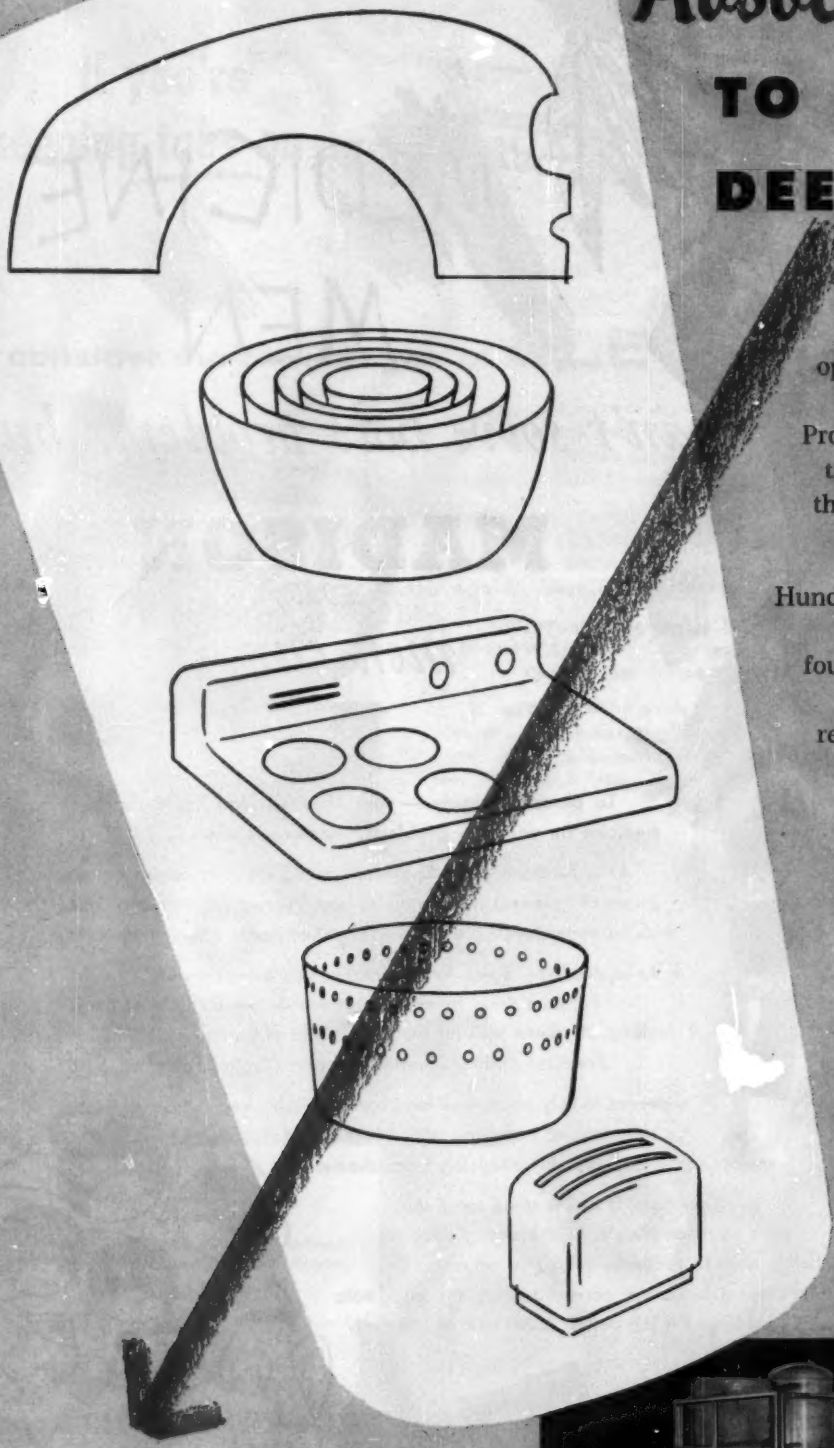

If deep drawing is one of the operations in your plant, you should know about the McKay Flex-Roll Processor, a rugged, efficient machine that quickly works steel to a degree that it can be deep drawn without tearing or showing draw strain.

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men can

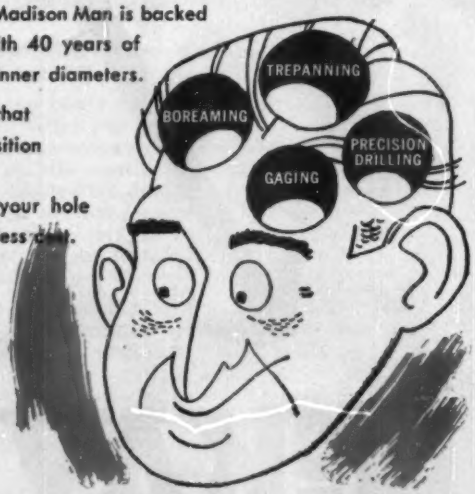
To phrase it simply — your Madison Man has the right medicine for your hole problems. And here's why . . .

As a Madison Sales Engineer he can expertly advise on every phase of hole-making relative to your current requirements, and with an understanding of the important operations surrounding them.

As a Madison Sales Representative his effectiveness is not channeled by selling just one or two methods of hole-making. He alone handles a complete line of Boring, Precision Drilling, Trepanning and Gaging Tools.

As a person to rely upon, your Madison Man is backed by a parent company with 40 years of specialized experience in producing inner diameters.

Therefore, it makes good sense that your Madison Man is in the strong position of being able to recommend to you on an honest and intelligent basis the correct tooling for your hole application that will do the job better, faster and at less cost.



MADISON MANUFACTURING COMPANY.
Dept. AM, Muskegon, Michigan

Please send Madison literature on:

- ☐ Adjustable Boring and Reaming Tools
- ☐ Precision Drills
- ☐ Trepanning Tools
- ☐ Adjustable Boregages

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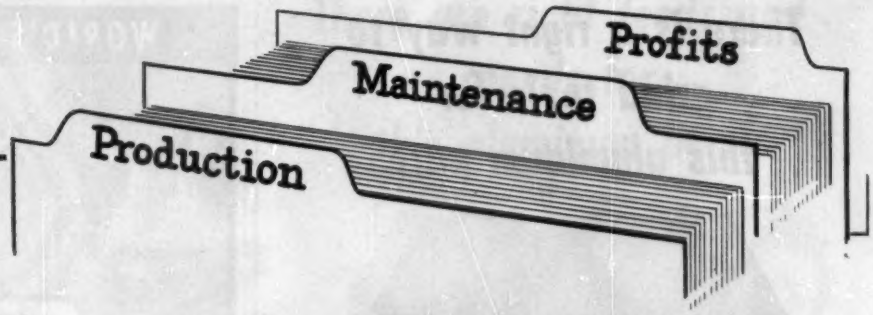
CITY_____ ZONE___ STATE_____

MADISON MANUFACTURING CO. INDUSTRIES, INC.

DEPT. PB, MUSKEGON, MICHIGAN

"inner diameters are our business"

If you're keeping tabs on—



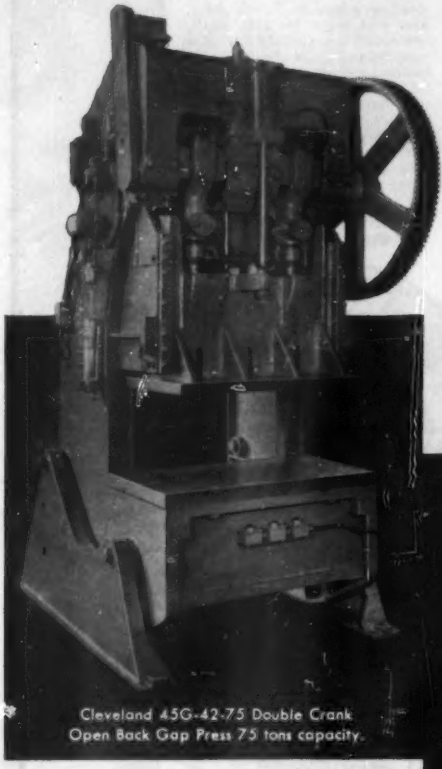
consider the advantages of CLEVELAND Presses

Here are three of our 11 specialized types of Cleveland Presses. Perhaps one of these may be your answer to greater stamping economy. If not, you can be sure that we can furnish you with just the *right* Cleveland for each of your particular needs.

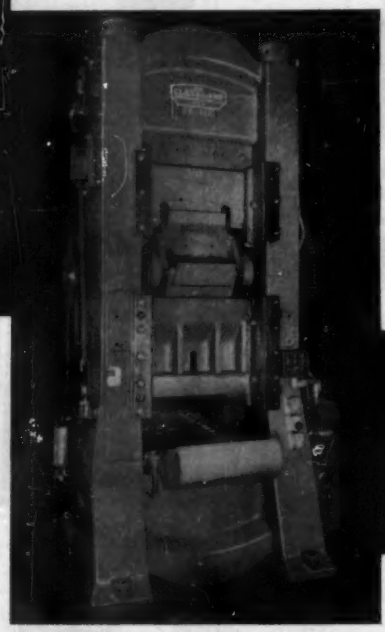
Construction of every Cleveland is simple and powerful with built-in reserve capacity for added safety and lasting accuracy. Rugged frame construction and extra long slide bearing surfaces eliminate slide deflection assuring stamping accuracy.

Our patented Cleveland Clutch gives you positive, fast control during all phases of operation. This reduces stamping rejects. Its light-weight construction demands less power for operation.

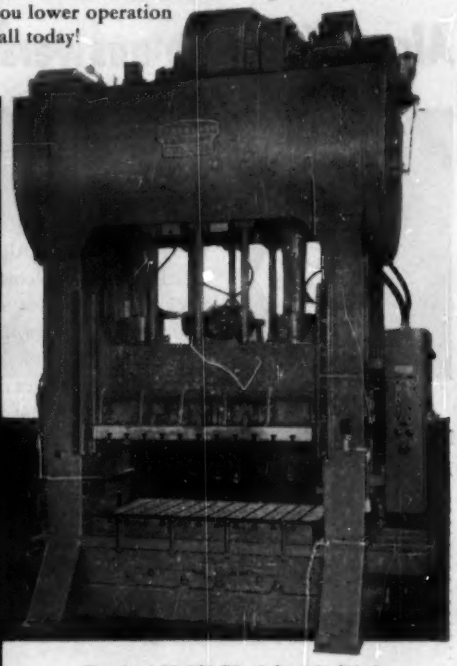
If you'll check the production and maintenance records of your older press equipment, we're sure you'll find that new Cleveland Presses designed to your specific requirements will give you lower operation costs for greater profits. Write or call today!



Cleveland 45G-42-75 Double Crank Open Back Gap Press 75 tons capacity.



Cleveland 8K Knuckle Joint Press equipped with conveyor type feed. 800 tons capacity.



Cleveland S2-250-72-42 Straight Sided Double Crank Press 250 tons capacity.

"Why Settle For Less Than a CLEVELAND Press"

THE CLEVELAND PUNCH & SHEAR WORKS CO.

Established 1880

1880 75 1955 YEARS OF CONSTANT PROGRESS

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POWER PRESSES

FABRICATING TOOLS

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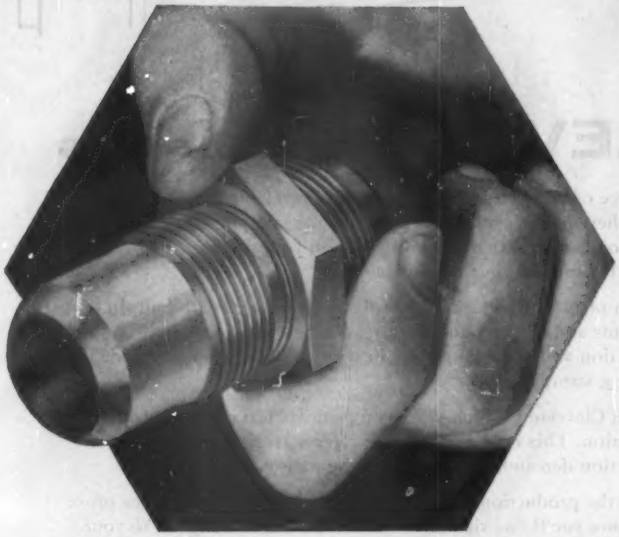
Offices at: NEW YORK • CHICAGO • DETROIT • PHILADELPHIA • E. LANSING

CITY FOUNDRY DIVISION • SMALL TOOL DEPARTMENT

There is a right way to grind tools for this aluminum part



Alcoa offers the answers here...

On many screw machine jobs there are operations which can be done in different ways, but, there is usually just one "best" way. To supplement your own experience, Alcoa offers users of Alcoa® Aluminum Screw Machine Stock a complete technical packet containing: calculators for feeds, speeds and properties; an engineering handbook on machining aluminum; a booklet of corrected tool diameter tables; case histories of savings; a conversion chart for alloy designations. The complete packet is free for the asking. Just fill out and mail coupon today.

ALUMINUM COMPANY OF AMERICA
874-K Alcoa Bldg., Mellon Square, Pittsburgh 19, Pa.
Gentlemen:
Please send your technical packet on Aluminum Screw Machine Stock to:

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Company_____

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Your Guide to Aluminum Value

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ALUMINUM COMPANY OF AMERICA
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BLADES
ROLLS
TOOLS
DIES
BAR STOCK
IMPROVED QUALITY
Additional refinements and improvements in our process have added still longer life to the wearing edges of Talide tools, dies and wear resistant parts. The result is a carbide having a new, unique grain structure with harder and tougher properties than previous grades. Laboratory tests reveal our improved grades possess 25% greater strength and rigidity. Service life per grind up to 50% longer than previous grades has been proven in grueling field tests.
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MC
TALIDE®
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HOT PRESSED AND SINTERED CARBIDES · VACUUM METALS
HEAVY METAL & CERMETS · HIGH TEMPERATURE ALLOYS
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

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Special Machinery

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You really get your money's worth when you buy precision screw machine products made by "you know W.H.O.*"

CAP SCREWS • COUPLING BOLTS
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. . . our specialty.

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Cutting-off should be done on a Hack Saw

Any way you figure it—speed, accuracy, squareness or cost—a hack saw will far out-perform a band saw when it comes to cutting-off from bars or billets. As builders of both band saws and hack saws we frankly admit this.

Basically, metal-sawing performance reduces to (1) the cutting-edge, (2) blade speed and (3) feed pressure, just as accuracy and squareness depend on the rigidity and tautness of the blade. In each of these basic factors the hack saw has a wide advantage—advantages which in actual results do average shop jobs as much as 4 times faster and for as little as 1/9th the blade cost.

Write for Catalog showing a complete, modern line of high-performance Metal Saws (Both "Band" and "Hack")

ARMSTRONG-BLUM MFG. CO.
5700 BLOOMINGDALE AVE. • CHICAGO, ILL.

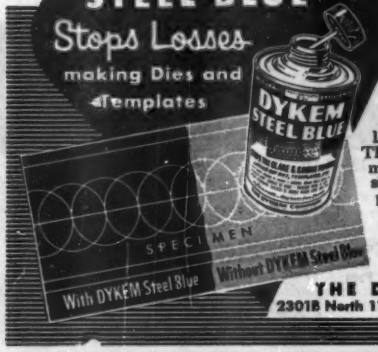
H&G Insert Chaser DIE HEADS

famous for accuracy and straightness of threads, low chaser costs, less downtime, more pieces per day.

THE EASTERN MACHINE SCREW CORP., 20-40 Barclay St., New Haven, Conn.
Pacific Coast Rep: *A. C. Berhringer, Inc., 334 N. San Pedro St., Los Angeles, Calif.* Canada: *F. F. Barber Machinery Co., Toronto, Can.*

DYKEM STEEL BLUE

Stops Losses making Dies and Templates



Popular package is 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

Write for sample on company letterhead

THE DYKEM COMPANY
2301B North 11th St. • St. Louis 6, Mo.

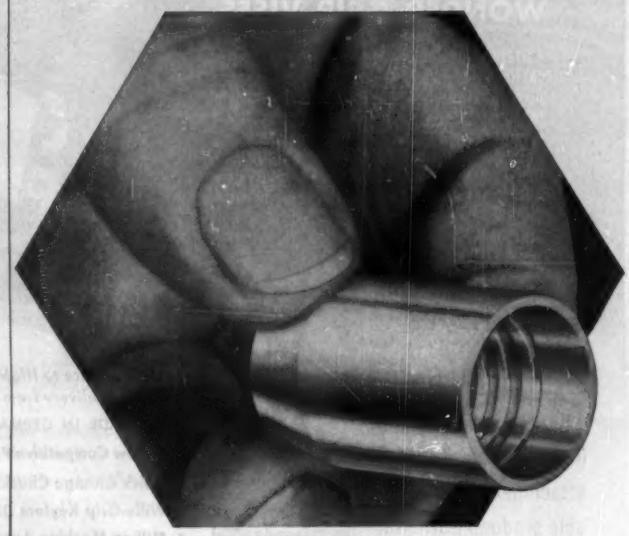
CUT SCRAPER TIME

END NIGHT CLEANUP & MORNING REBLUING

DYKEM HI-SPOT BLUE No. 107 is used to locate high spots when scraping bearing surfaces. As it does not dry, it remains in condition on work indefinitely, saving scraper's time. Intensely blue, smooth paste spreads thin, transfers clearly. No grit; noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.

THE DYKEM CO., 2301-B NORTH 11TH ST., ST. LOUIS 6, MO.

There are right feeds and speeds for this aluminum part



Alcoa offers the answers here...

On many screw machine jobs there are operations which can be done in different ways, but, there is usually just one "best" way. To supplement your own experience, Alcoa offers users of Alcoa® Aluminum Screw Machine Stock a complete technical packet containing: calculators for feeds, speeds and properties; an engineering handbook on machining aluminum; a booklet of corrected tool diameter tables; case histories of savings; a conversion chart for alloy designations. The complete packet is free for the asking. Just fill out and mail coupon today.

ALUMINUM COMPANY OF AMERICA
874-JM Alcoa Bldg., Mellon Square, Pittsburgh 19, Pa.

Gentlemen:
Please send your technical packet on Aluminum Screw Machine Stock to:

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Your Guide to Aluminum Value

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ALUMINUM COMPANY OF AMERICA
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MULTI-PURPOSE WONDER GRIP VISES

Horizontal Swivel Type

4 STEPPED JAWS PERMIT CLAMPING of rough castings, irregularly shaped, round, and tapered pieces accurately and quickly, eliminating need for special jigs or fixtures. Narrow stepped jaws allow free access to and measuring of work pieces and provide clearance for cutting tools. Small work pieces machined on three sides without reclamping. Easy and quick to mount and align on any machine. Holds rigid in any position without vibration. Various capacities and extra soft jaws available.

Horizontal & Vertical Swivel Type

TAPPING ATTACHMENTS

Reversible safety tapping attachments with adjustable graduated friction drive, hardened, ground and lapped, complete with torque bar and handles. Precision made throughout by long established reputable West German factory.

Tested for Performance to High Amer. Standards
Immediate Delivery from N.Y. Stock
MADE IN GERMANY
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- Quick Change Chucks and Collets
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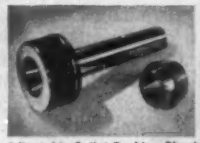
SOUTH BEND LATHE ATTACHMENTS

- *Increase Lathe Versatility*
- *Simplify Difficult Jobs*
- *Perform Special Classes of Work*

Handlever Collet Attachment

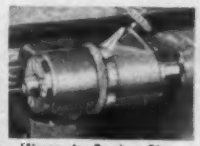
Telescopic Taper Attachment


Adjustable Collet Bushing Chuck

Steel and Brass Collets

Safety and Standard Lathe Dogs

Telescoping Jaw Follower Rest and Center Rest


Micrometer Carriage Stop

Handwheel Collet Attachment

Milling Attachment

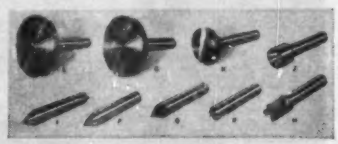
Ball Bearing Live Center

10 in 1 Tool Holder

Thread Dial Indicator

External Grinder

Centers, Drill Pads



Write for Catalog 5418
SOUTH BEND LATHE
Building Better Tools Since 1906
South Bend 22, Indiana

RUSSELL HYDR. SAWING MACHINES

All sizes up to 14" capacity, with and without automatic stock feed
Ask for catalogs
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The "MASTER COMPAR" INDICATING MICROMETER COMPARATOR has the VISIBLE feel

No Arguments as to correctness of reading due to "feel".

To attain permanent accuracy at these close limits, highest precision workmanship and exclusive design of mechanism are of Major importance and ONLY found in "MASTER COMPAR".

Use it as Comparator, Master Micrometer, Go & No Go Gage.

1" Range reading in 1/10,000"

A RIGHT HAND TOOL
Release button for movable Anvils on RIGHT Hand side enables you to hold tool the conventional way.
NEW— Resetting to Zero in 5 seconds
Quick adjustable tolerance bands. Heavy TUNGSTEN CARBIDE Anvils will actually measure Out-of-Roundness, Ovalness and Taper.

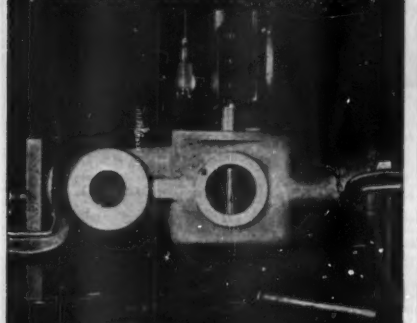
0-1" SIZE IN HARDWOOD CASE

$95.00

Ask for Illustrated Circular — Code GIOFF
Sold thru Tool Supply Houses
Ask for Demonstration
Also Available in LARGER SIZES

GEORGE SCHERR CO., INC. 200-AM LAFAYETTE STREET • NEW YORK 12, N.Y.

33% DECREASE IN DIE WEAR ON THIS GRAY IRON FITTING



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Users everywhere report similar experiences. In fact, on 67 machining tests in 11 large machine shops, castings of gray iron treated with FERROCARBO averaged 89.5% greater machinability per tool than untreated castings. These premium castings are finer-grained, denser, stronger, yet they COST YOU NO MORE, because your foundryman, using FERROCARBO, makes worthwhile savings in raw material costs.

FOR FREE BOOKLET on FERROCARBO, citing actual case histories of faster machining, with longer tool life, write The Carborundum Company, Dept. 15, Niagara Falls, N.Y. 84-55

CARBORUNDUM®

COMPACT
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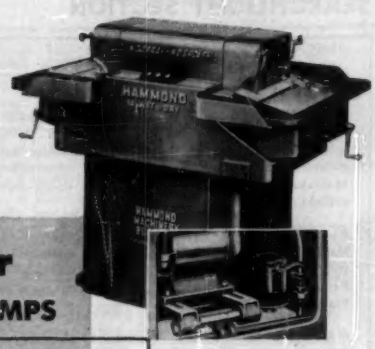
CONVENIENT

Ruthman
Gusher
COOLANT PUMPS



The compact, simple design of all Gusher Coolant Pumps assures you of maximum performance in a minimum of space. Wherever you mount it, a Gusher Coolant Pump is ready to go to work. There's no priming necessary, you get instantaneous coolant flow.

Gushers require little or no maintenance, the ball bearings are pre-lubricated. There is no packing to worry about and the rugged construction and dynamically balanced rotating assembly cut wear to a minimum. Always specify Gusher for your coolant needs.

Illustrated is a Hammond Model 14-WD Wet or Dry Carbide Tool Grinder — the inset shows a Gusher Coolant Pump mounted inside the base.

THE RUTHMAN MACHINERY CO.

1818 Reading Road **Cincinnati, Ohio**

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CHICAGO: 520 N. Michigan Ave. (11)
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General Foreman for machine shop and structural shop employing approximately 120 men. Must have thorough knowledge of up to date tools and manufacture of heavy machine structures. P-8412, American Machinist.

Advertising man, copy-layout, familiar with machine tools. Well known machinery company. Send complete resume. Our staff knows of this ad. P-8529, American Machinist.

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Well established Cleveland firm of sales engineers, operating throughout northern Ohio, presently representing four nationally known machine tool manufacturers exclusively, open for one additional account. We offer considerable experience, versatility, and competence in sales engineering, with thorough knowledge and coverage of territory. Interested only in American quality line backed by good engineering and manufacturing facilities. Write RA-7934, American Machinist.

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START TO $900 MONTH
Michigan mfr. Engines—750 employees—200 in M.S. Dept. Def. Oppor. further advancement.
RAY EDWARDS AND ASSOCIATES
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WANTED
MACHINE TOOL SALES ENGINEER
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World's Fastest Threading Lathe
Send Complete Resume
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PEACOCK CORPORATION
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PRODUCTION SUPERVISOR

Exceptional opportunity for permanent position responsible DIRECTLY TO THE PRESIDENT for man under 40 with good education and experience in mass production especially of medium sized forgings, hardening and finishing, and to set up and operate production control and cost in modern progressing plant with friendly atmosphere. Apply in confidence with full information to:

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ALUMINUM SPECIALTY MFG. CO., So. Cen. Ariz. Phoenix area. Netted $12,000 in 6 mo., 1955. Mfg. car ports, garage doors, alum. awnings, and exclsve. nationally-known aluminum umbrellas. Ideal loc. Priced far below value for quick sale. Liberal terms. **Dept. #22625—15M**

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MACHINE TOOL RECONDITIONING & the Art of Hand Scraping

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Sales are direct to industrial users.

- **The right man should have successful sales management experience with such products as: ELECTRIC MOTORS—MACHINE TOOLS—CONTROLS—TURBINES —COMPRESSORS . . . (or similar equipment)**
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Excellent bonus, insurance and retirement program in addition to salary stated above.

Your reply will be treated in complete confidence and should include age, present connection and home telephone number.

P-8547, AMERICAN MACHINIST
330 W. 42 St., New York 36, N. Y.

WANTED TO MERGE

Profitable corporation wishes to merge into a corporation with a tax loss carry-forward of $500,000 or more. Replies held in strictest confidence.

BO-8355, AMERICAN MACHINIST
330 W. 42 St., New York 36, N.Y.

MACHINERY WANTED
Thread Grinder

Jones & Lamson late type thread grinder, 12" capacity, 36" centers, no more than five years old. Give Serial No., year built and asking price.

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25 to 35; excellent opportunity for person fully experienced in selling small cutting tools such as milling cutters, end mills, reamers and hobs; must be familiar with all phases of selling and servicing customers, as well as practical experience in use of these tools. We are looking for a man currently employed in this field who is looking forward to advancement to sales manager; salary open. Please send complete resumé and salary requirements. Address

P-8543, AMERICAN MACHINIST
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Foreign Manufacturer of high quality Turret Lathes, Automatic Lathes, Vertical Milling and Boring Machines, Automatic Keyway Milling Machines, Internal Grinders, Slotters, Table and Way Grinders, Special Machinery, has exclusive territories available throughout the United States for machine tool dealers. These machines are backed up with national advertising, tool show participation and service and parts available in this country. Manufacturers agents with experience and initiative to establish dealerships will also be considered. State experience and qualifications.

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INDUCTION HEATING EQUIPMENT

1—7½ KW TOCCO M. G. type, Single Station Induction Heating Unit.
1—7½ KW THERMONIC High Frequency Tube type Induction Heating Unit. New.
1—50 KW—960 Cycle High Frequency Induction Unit; for heating or vacuum melting.
1—600 KW—960 Cycle Motor Generator Unit
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Machine Tool Manufacturers of Turret Ram Type Vertical Miller Machine

We will sell patterns, jigs, fixtures, prints and all rights to manufacture our line of millers. Our line is well established throughout the United States by a great number of active dealers supplying more orders than we can take care of at present.

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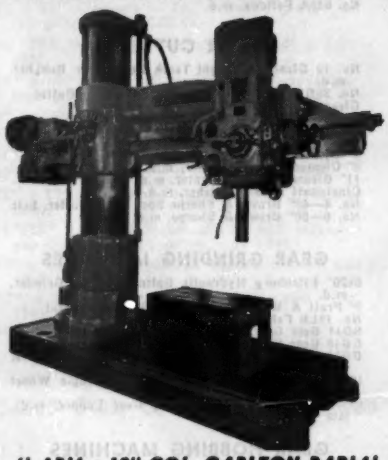

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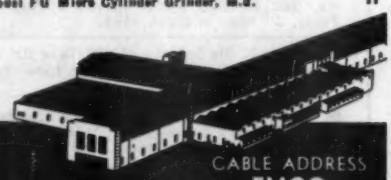

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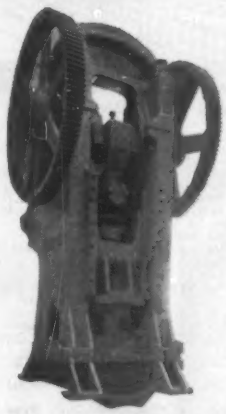

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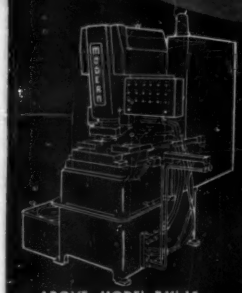

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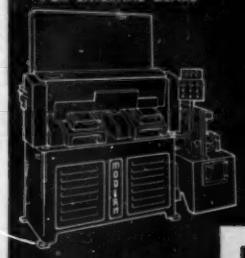

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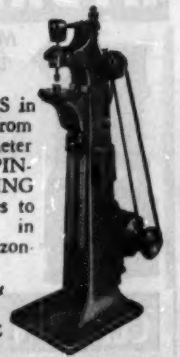

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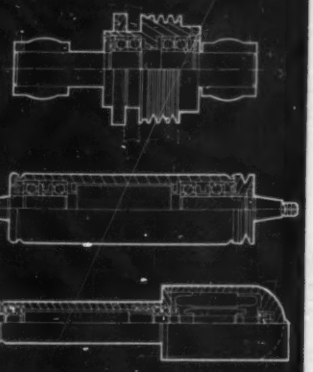

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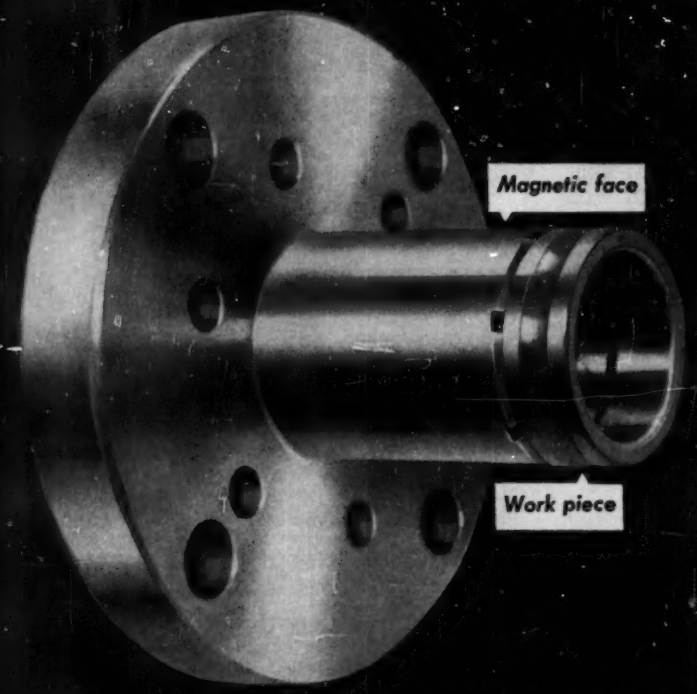

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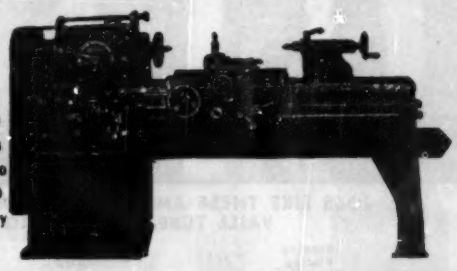

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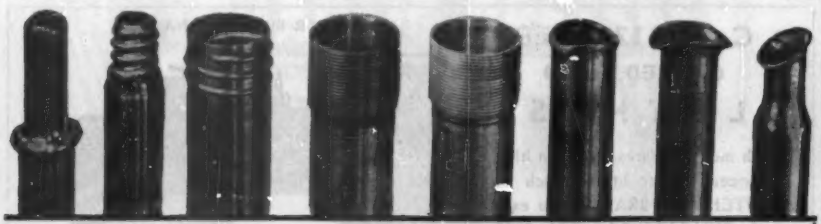

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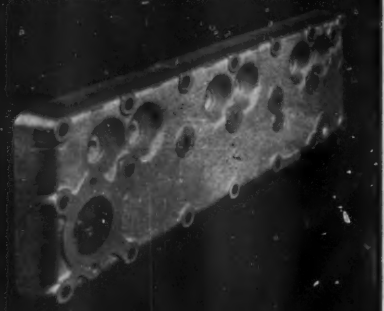

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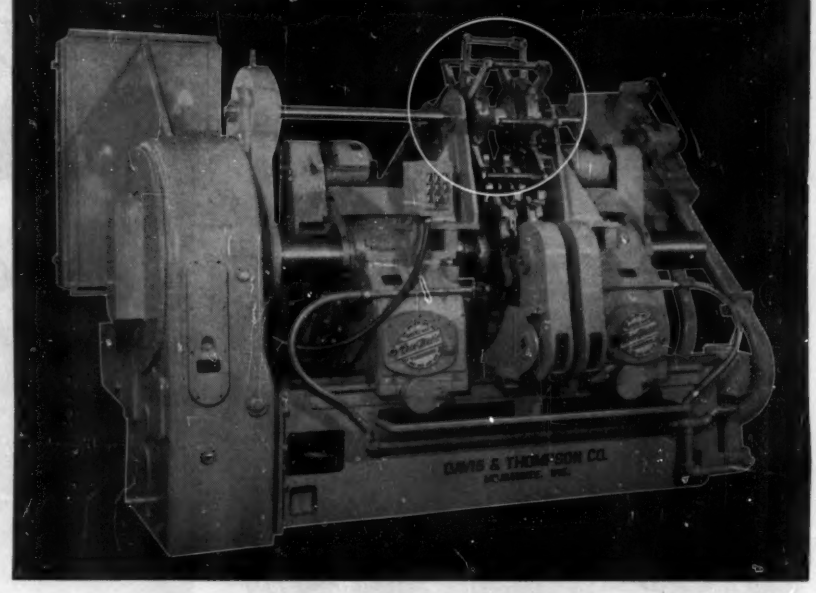

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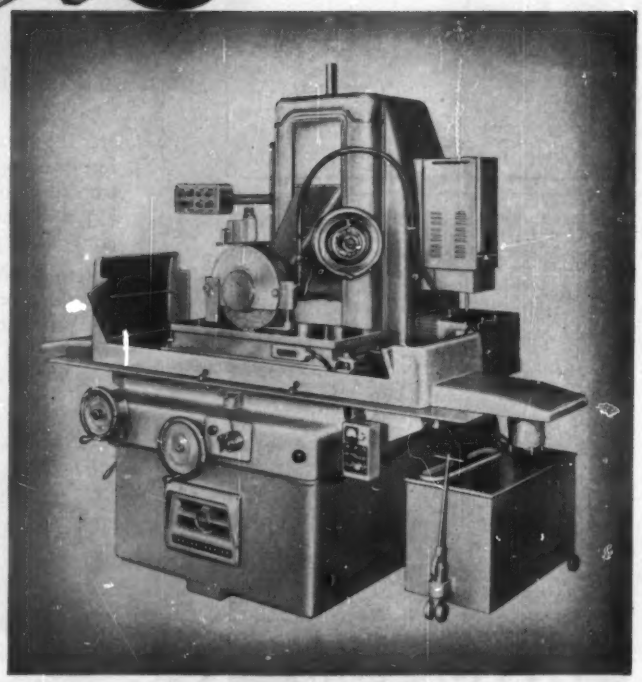

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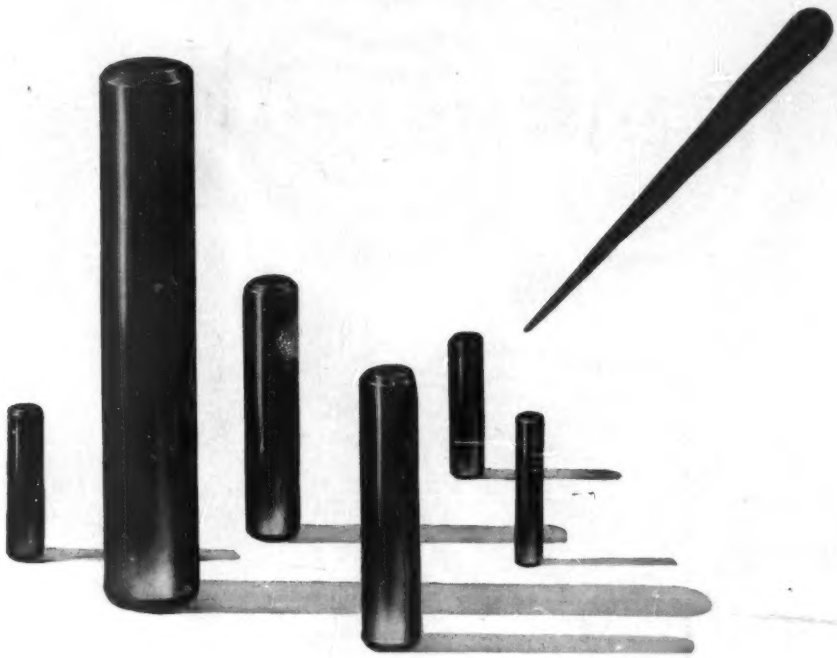

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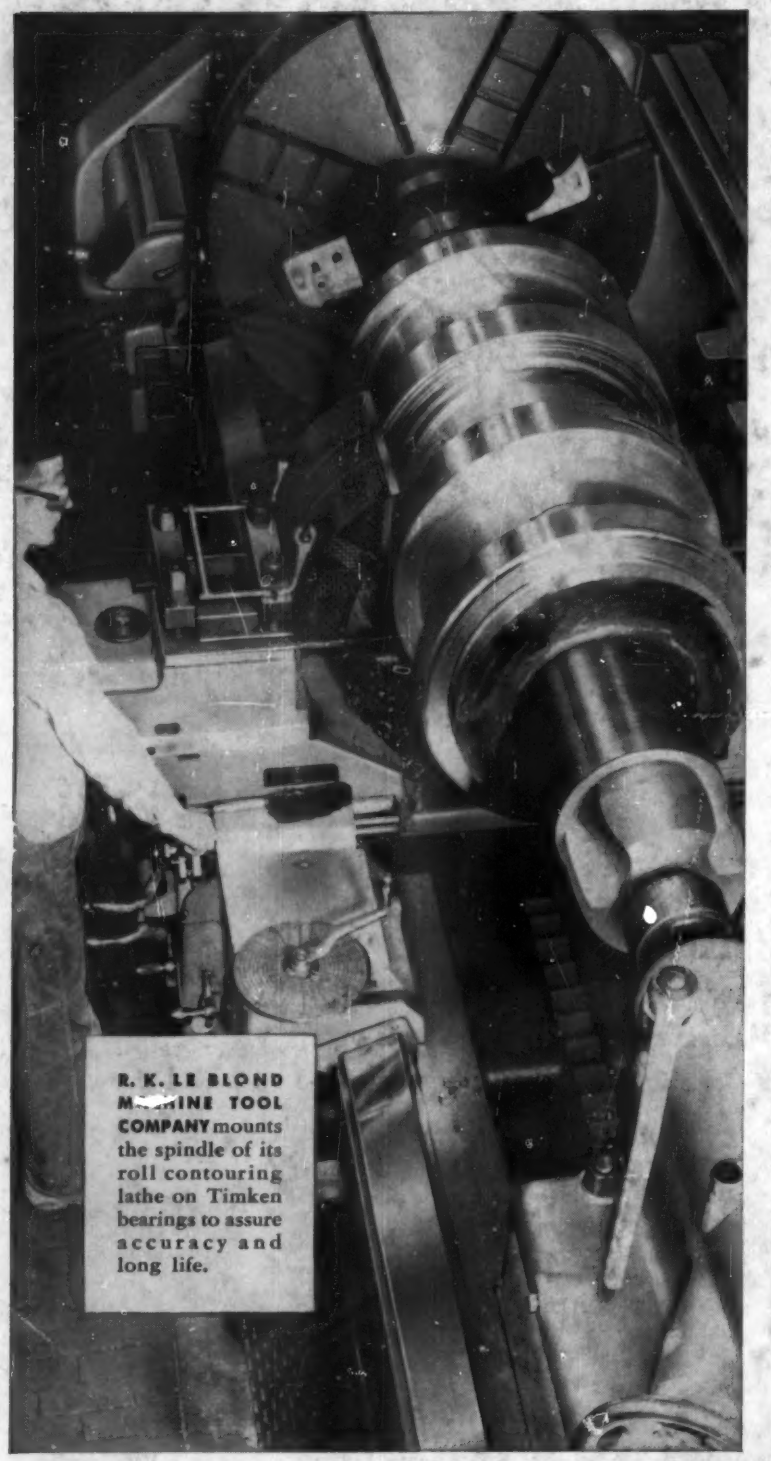

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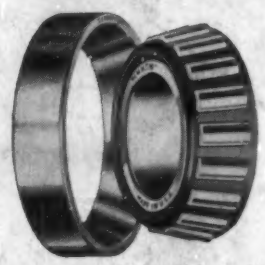

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The special grade alloy steel which gives Timken bearings their strength and resistance to wear is made in our own steel mills.

Only Timken tapered roller bearings have these advantages: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. nickel-rich Timken alloy steels.

NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭ BEARING TAKES RADIAL ◐ AND THRUST →◐← LOADS OR ANY COMBINATION →✳←